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Mine Permit Number MO450017 Mine Name Mercur Mine
Operator BARRICK Resources Date 6-4-1998
TO _____ FROM _____

CONFIDENTIAL BOND CLOSURE LARGE MAPS EXPANDABLE
 MULTIPUL DOCUMENT TRACKING SHEET NEW APPROVED NOI
 AMENDMENT OTHER

Description YEAR-Record Number

NOI Incoming Outgoing Internal Superceded

Appendix B Stor Water management
methodology and Design

NOI Incoming Outgoing Internal Superceded

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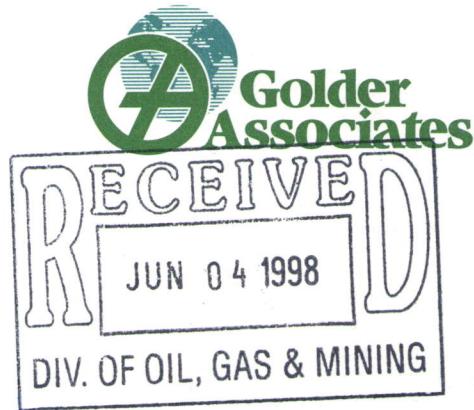
TEXT/ 81/2 X 11 MAP PAGES 11 X 17 MAPS LARGE MAP

COMMENTS: _____

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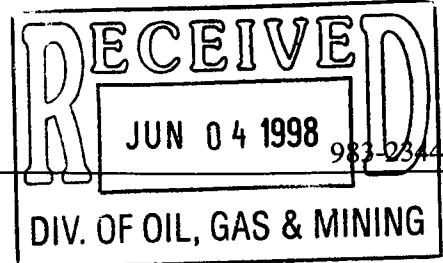
APPENDIX B
STORMWATER MANAGEMENT
METHODOLOGY AND DESIGN

Prepared for:

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STORMWATER MANAGEMENT, METHODOLOGY AND DESIGN

B.1 INTRODUCTION

The following discussion has been provided to support the technical review of the stormwater diversion channel design for Barrick Resources (USA) Mercur Mine Reclamation Project. This discussion provides the methodology that has been applied in developing the design storm event and the design of the diversion channels. The detailed design of the diversion channels is illustrated in an engineering design drawing set entitled *Barrick Resources (US), Mercur Mine, Stormwater Diversion Channel*, prepared by Golder Associates (1998). These drawings should be reviewed in conjunction with this discussion. Following this discussion is the supporting output and calculations that provide the technical basis for the design.

B.2 DESIGN STORM EVENT

Selection of an appropriate storm event and the estimation of the peak runoff rate for use in sizing and design of the stormwater diversion channels has incorporated the following considerations:

- ▶ Historical rainfall records;
- ▶ Synthetic hydrograph computations for various recurrence interval, 24-hour storm events;
- ▶ Estimates of the historical basin flows conveyed by downgradient, unimpacted natural channels; and,
- ▶ The infinite design life of the channels.

Daily rainfall records for the Mercur site have been obtained for the period August 1983 to present. A summary of the rainfall records are provided in Appendix B-1. Appendix B-1 indicates that over the period of record, the maximum daily rainfall event was 1.69 inches which occurred on August 21, 1995.

Isopluvial contour (lines of equal rainfall) maps prepared by the National Oceanic and Atmospheric Administration (NOAA) for the state of Utah (Miller, et.al., 1973) indicate 24-hour duration storms for the Mercur site as shown in Table B-1.

TABLE B-1
Mercur Mine Site, 24-hour Duration Rainfall

Recurrence Interval	24-Hour Rainfall Totals
2-year	1.8 inches
10-year	2.6 inches
50-year	3.4 inches
100 year	3.8 inches

Based on Miller et.al, 1973.

Statistically, the 2-year 24 hour event would be expected to be exceeded seven times during the 14.5 year Mercur Mine Site historical rainfall record (Appendix B-1). The records indicate that a measured daily rainfall of 1.1 inches was exceeded seven times¹. So, based on the historical record, the 2-year, 24-hour event is approximately 1.1 inches, which is less than that estimated by the NOAA Atlas. The historical database is too short to estimate longer recurrence interval events.

A stormwater hydrology program, StormSHED (Boss, International, 1996) was applied to compute synthetic runoff hydrographs for 2-year, 10-year, 50-year and 100-year, 24-hour

1. Rainfall records provided list the maximum daily rainfall event for each month. Not all of the large storm events will be represented in the rainfall records if more than one large event occurred in one month.

storm events from NOAA data. Hydrographs were prepared using the Soil Conservation Service (SCS) Curve Number/Unit Hydrograph approach (SCS, 1972). Derivation of curve numbers was completed in previous studies by JBR Environmental (1997) and is based on soils and vegetative community surveys of the drainage basin. Curve numbers that were developed and have been applied are:

- ▶ undisturbed ground 60
- ▶ disturbed ground 81

The intensity of rainfall over the 24-hour period is modeled using a SCS Type II rainfall distribution which is appropriate for the state of Utah. The times of concentration were computed based on the subbasin dimensions, slope, ground condition, and degree of channelization as estimated from available topographic maps using methods described in the SCS TR-55 Manual (SCS, 1986).

Hydrographs were generated for each drainage basin tributary to the diversion channels. The drainage sub-basins that have been applied are identified herein on Figure 2.4-1. Hydrographs were routed through drainage channel reaches and summed at points of confluence. The peak flow rate for each storm event was computed for each channel reach. Outputs from the StormSHED synthetic model are provided in Appendix B-2. Table B-2 summarizes the peak flow rate for each channel reach. The channel reaches, defined as Reaches A through M are shown on the Stormwater Diversion Channel Construction Drawings (Golder, 1998).

TABLE A-2
24 Hr Synthetic Storm Event, Peak Flow Rates

Reach	From	To	SYNTHETIC STORM PEAK RUNOFF			
			Q_{2yr} 1.8" (cfs)	Q_{10yr} 2.6" (cfs)	Q_{50yr} 3.4" (cfs)	Q_{100yr} 3.8" (cfs)
Northern						
A	87+50	108+92	11	49	124	173
B	81+00	87+50	18	69	163	221
C	56+00	75+00	19	109	329	492
C1	0+00	12+71	12	49	170	256
D	44+00	56+00	21	131	418	629
E	40+00	44+00	21	131	415	623
F	28+50	40+00	22	131	415	623
G	0+00	28+50	22	139	415	623
Southern						
H	79+50	54+00	6	26	77	119
I	54+00	56+00	6	25	75	112
J	42+00	54+00	6	29	75	112
K	26+00	42+00	11	29	93	133
L	21+50	26+00	11	33	99	139
M	19+00	21+50	11	33	99	139
N	0+00	9+00	85	147	393	492

The Northern and Southern diversion channels will discharge into the Golden Gate Pit. Prior to the development of the Golden Gate Pit, runoff from the drainage basin area discharged through the natural outlet channel in Mercur Canyon. A field survey was conducted in Mercur Canyon, near the existing guard shack, to accurately measure the natural channel dimensions and to estimate the flow rates of the channel. Photographs of the channel reach that was surveyed are included in Appendix B-3. The natural channel characteristics including the slope, entrenchment ratio, channel bed materials and bankfull depth as determined using Rosgen (1996), indicate that the typical flood (i.e. the flood that gives rise to the channel characteristics) has a flow rate of approximately 84 cfs. This compares relatively closely to the synthetic 2-year storm event (i.e. the sum of Reach G

and Reach N). The bankfull flow is typically associated with 1.5 to 5 year return period floods (Rosgen, 1996). The flow rate associated with the flood prone depth (as defined by Rosgen, 1996) was estimated to be 283 cfs which corresponds closely to the 10-year 24-hour synthetic storm event. The flow rate associated with a water depth to the crest of the channel was estimated at 890 cfs approximately equivalent to the theoretically predicted 50-year synthetic storm event. There was no morphologic evidence that flows have periodically overtopped the channel crest.

B.3 CHANNEL DESIGN

The storm water diversion channels have been generally designed to be self-maintaining and to convey, without failure, the 100-year, 24-hour, synthetic storm event. In general, the extreme storm events (i.e. greater than 10-year recurrence) are contained by the overall grading of the site, either natural or through regrading performed as part of the site reclamation. An extreme storm event is anticipated to result in some erosion of the channel bed and banks, similar to that which occurs in nature. However, based on material characterization performed during site investigation activities and channel armoring calculations, the depth of erosion will be within acceptable limits. Where unacceptable erosion would occur, appropriately sized riprap is provided. Riprap sizing and channel armoring calculation are provided in Appendix B-5.

Where feasible, the channel design is based on natural channel morphology principles and channel classification systems (Rosgen, 1996). By establishing a channel type using the Rosgen classification system that is close to the natural stable tendencies that the channel would eventually assume in time (if left to natural processes given the slope and the channel bed materials) then the channels will undergo less trauma (i.e. erosion, deposition, braiding, bank sloughing, etc), over the course of time.

Some of the channel reaches are relatively steep (Reaches F, G, J, and N). To keep flow velocities in check and to avoid erosion and down-cutting of the channel, rock vortex weirs have been employed in the channel design. Rock Vortex weirs occur in nature in relatively steep channel segments and function to dissipate energy and control headward erosion. Rock vortex weirs to be constructed consist of large riprap that will not be transported at the flow velocities encountered. They are keyed into the channel bed a depth greater than the predicted depth of scour. The weirs act as step structures for step-pool type channels and are spaced a sufficient distance apart to allow the hydraulic jump to occur between weirs. The height of the weirs is determined by a consideration of the hydraulic jump length and the required step height to achieve the channel slope. The riprap is placed so that the weir forms an upstream-facing "V". This configuration promotes turbulence to be directed to the center of the channel to form a scour pool, rather than causing bank erosion.

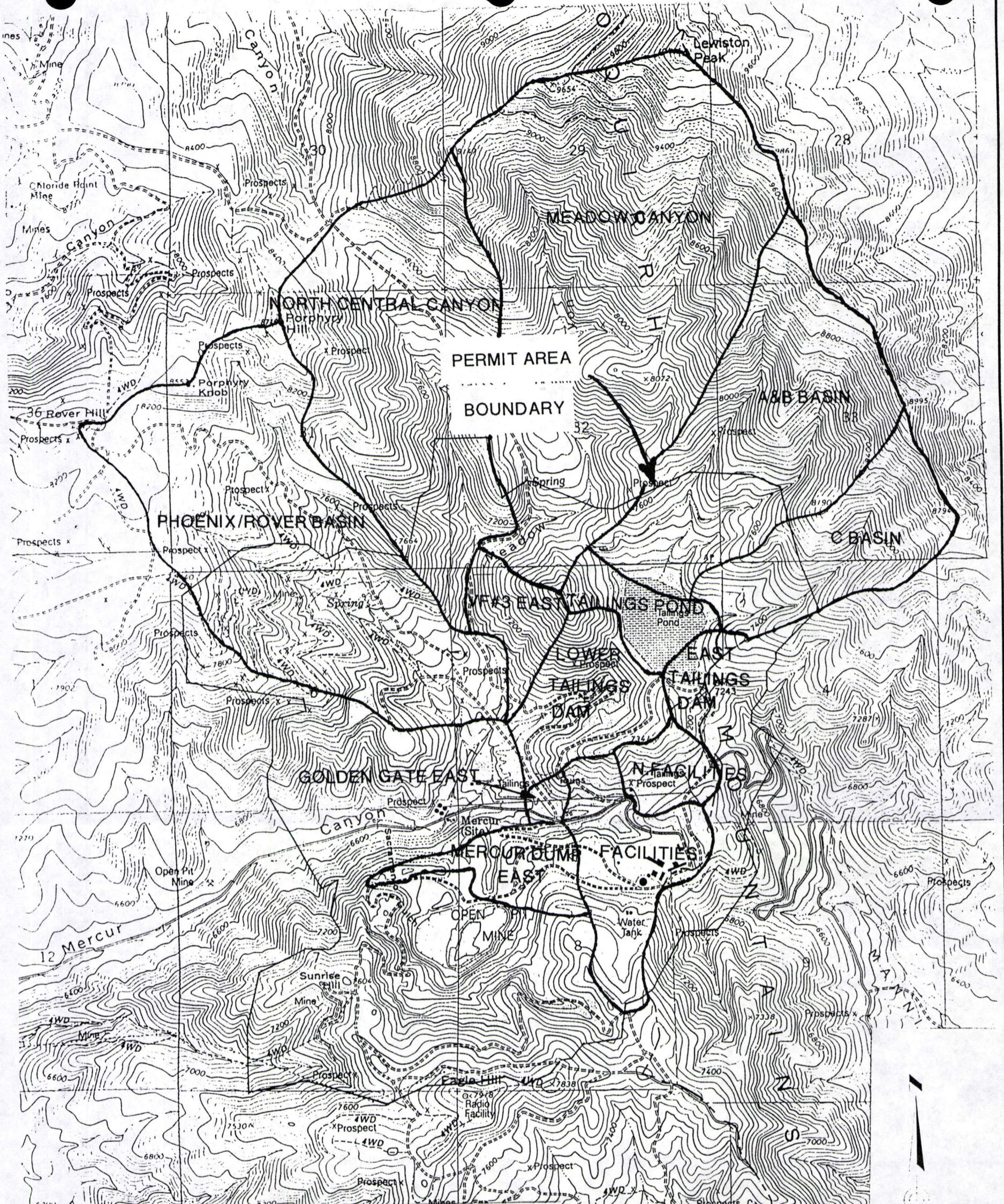
Minor sections of the diversion channel are very steep (Reaches I and L) and the slopes cannot be accommodated with a step-pool type channel. These channel sections will be riprap protected their entire length and energy dissipation structures will be provided at their terminus.

In some areas, a natural channel type cannot be provided because the channel is aligned on a side hill or because of space constraints (Reaches A, B, D, E, H, and J). These channel sections are designed using conventional hydrology analyses to contain, without excessive erosion, the 100-year, 24-hour storm within the constructed channel cross section.

Typical channel cross sections and the channel alignments are shown on the design drawings. Appendix B-4 provides output from FlowMaster (a Manning flow equation, hydraulics program (Haestad, 1996) for each channel reach for the 10-year and the 100-year synthetic storm events.

REFERENCES

- Boss International, 1995, Boss StormSHED, Madison WI.
- Haestad Methods, 1996, FlowMaster for Windows, Waterbury, CT
- JBR Environmental Consultants, Inc. (1997), Conceptual Plan for Regrading, Surface Water Hydrology and Stormwater Routing. Prepared for Barrick Mercur Mine.
- Rosgen, D.L., 1996, Applied River Morphology, Wildland Hydrology, Pagosa Springs, CO.
- SCS, 1986, Urban Hydrology for Small Watersheds, Technical Release 55, U.S. Department of Agriculture.
- Golder Associates, Inc., 1998, Barrick Resources (USA) Mercur Mine, *Stormwater Diversion Channels*, 21 drawings, revision 1 "Issued for Construction".
- Miller, J.F., et.al., 1973, Precipitation-Frequency Atlas of the United States, NOAA Atlas 2, National Oceanic and Atmospheric Administration, National Weather Service, Silver Spring, ND.



Basin Name	Basin Description									
	Undisturbed			Disturbed			Synthetic Storm Event			
	Area (acres)	Time of Conc. (min.)	Area (acres)	Time of Conc. (min.)	Total Area (acres)	2 Year Event	10 Year Event	50 Year Event	100 Year Event	
NORTH HYDROLOGY										
A + B	415.6	49.63	60.0	65.72	475.6	12.4	48.51	126.7	179.2	
Tailings Pond	13.8	16.01	53.5	72.83	67.3	10.3	24.67	41.5	50.7	
Meadow Canyon	922.9	33.90	9.3	16.75	932.2	4.6	55.7	230.2	353.0	
North Central Canyon	526.0	25.49	20.0	8.33	546.0	11.5	48.6	170.1	256.1	
Valley Fill #3 East	55.0	10.80	41.2	11.19	96.2	21.6	53.01	101	129.7	
Phoenix/Rover	437	47.76	254	16.4	691	126	293.65	508.4	628.8	
Lower Tailings Dam	80.4	19.84	38.6	18.76	119.0	18.0	46.2	93.26	122.2	
SOUTH HYDROLOGY										
C	196.3	20.82	22.0	42.84	218.3	6.2	26.73	81.6	119.3	
East Tailings Dam	21.0	12.87	22.1	12.87	43.1	11.5	27.36	50	62.9	
North Facilities	33.6	7.05	6.8	4.70	40.4	4.1	11.92	29.4	40.86	
Facilities	55.0	30.62	117.9	11.25	172.9	61.8	140.86	234.8	285.6	
Mercur Dump East	5.8	16.18	72.2	29.06	78.0	26.5	61.34	101.5	123.2	
Golden Gate East	0.0	N/A	13.1	9.65	13.1	7.2	16.32	26.56	31.9	

BARRICK RESOURCES (USA) INC.
MERCUR MINE



Tucson, Arizona

TITLE DRAINAGE SUBBASIN MAP

I.JW CHECKED

BRB REVIEWED

BRB

DATE

3/29/98

SCALE

1"=2000'

FILE NO.

JOB NO. 983-2344 DWG. NO./REV. NO.

FIGURE 2.4-1

YEAR	MONTH	PRECIP. (in.)	DAILY MAX(in)	DATE OF MAXIMUM
1983	JAN.	N.D.	N.D.	N.D.
	FEB.	N.D.	N.D.	N.D.
	MAR.	N.D.	N.D.	N.D.
	APR.	N.D.	N.D.	N.D.
	MAY	N.D.	N.D.	N.D.
	JUN.	N.D.	N.D.	N.D.
	JUL.	N.D.	N.D.	N.D.
	AUG.	1.8	1.5	8/18/83
	SEP.	1.43	0.36	9/02/83
	OCT.	1.12	0.35	10/01/83
	NOV.	1.46	0.18	10/24/83
	DEC.	3.07	0.66	12/25/83
	Total:	8.88	1.5	AUG. '83
1984	JAN.	1.39	0.52	1/13/84
	FEB.	1.38	0.6	2/26/84
	MAR.	1.3	0.32	3/31/84
	APR.	1.6	0.43	4/01/84
	MAY	0.85	0.46	5/31/84
	JUN.	1.6	0.9	6/06/84
	JUL.	1.56	0.52	7/30/84
	AUG.	1.34	0.38	8/17/84
	SEP.	1.47	0.71	9/20/84
	OCT.	2.04	0.79	10/02/84
	NOV.	1.16	0.35	11/08/84
	DEC.	1.13	0.35	12/19/84
	Total:	16.82	0.9	JUN. '84
1985	JAN.	1.5	0.4	1/05/85
	FEB.	0.95	0.26	2/09/85
	MAR.	1.6	0.58	3/10/85
	APR.	0.59	0.3	4/24/85
	MAY	3.3	0.82	5/10/85
	JUN.	1.2	0.52	6/24/85
	JUL.	3.79	1.28	7/22/85
	AUG.	0.13	0.11	8/05/85
	SEP.	1.76	0.84	9/11/85
	OCT.	1.49	0.65	10/06/85
	NOV.	2	N.D.	N.D.
	DEC.	0.89	0.47	12/02/85
	Total:	19.2	1.28	JUL. '85
1986	JAN.	1.61	0.56	1/30/86
	FEB.	3.55	0.85	2/17/86
	MAR.	2.56	0.68	3/08/86
	APR.	3.45	0.85	4/01/86

YEAR	MONTH	PRECIP. (in.)	DAILY MAX(in)	DATE OF MAXIMUM
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	MAY	1.44	0.49	5/08/86
	JUN.	0.42	0.3	6/04/86
	JUL.	2.03	0.69	7/15/86
	AUG.	3.2	1.52	8/21/86
	SEP.	2.04	0.45	9/24/86
	OCT.	1.39	0.59	10/01/86
	NOV.	0.95	0.4	11/07/86
	DEC.	0.41	0.21	12/05/86
	Total:	23.05	1.52	AUG. '86
1987	JAN.	1.23	0.34	1/05/87
	FEB.	1.8	0.73	2/13/87
	MAR.	1.93	0.4	3/18/87
	APR.	1.43	0.91	4/05/87
	MAY	2.02	0.54	5/18/87
	JUN.	1.75	0.83	6/29/87
	JUL.	2.84	0.67	7/21/87
	AUG.	1.47	0.4	8/24/87
	SEP.	0.33	0.23	9/03/87
	OCT.	1.74	0.44	10/13/87
	NOV.	1.97	0.42	11/01/87
	DEC.	1.27	0.53	12/22/87
	Total:	19.78	0.91	APR. '87

YEAR	MONTH	PRECIP. (in.)	DAILY MAX(in)	DATE OF MAXIMUM
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1988	JAN.	1.63	0.57	1/05/88
	FEB.	0.07	0.05	2/18/88
	MAR.	1.75	0.5	3/10/88
	APR.	1.86	0.69	4/18/88
	MAY	1.7	0.75	5/29/88
	JUN.	0.6	0.33	6/22/88
	JUL.	1.52	0.91	7/30/88
	AUG.	0.5	0.37	8/06/88
	SEP.	0.78	0.45	9/13/88
	OCT.	0.89	0.62	10/12/88
	NOV.	2.01	0.36	11/03/88
	DEC.	0.96	0.34	12/22/88
	Total:	14.27	0.91	JUL. '88
1989	JAN.	0.66	0.17	1/06/89
	FEB.	2.73	0.8	2/02/89
	MAR.	1.95	0.4	3/19/89
	APR.	0.9	N.D.	N.D.

YEAR	MONTH	PRECIP. (in.)	DAILY MAX(in)	DATE OF MAXIMUM
	MAY	0.79	0.22	5/31/89
	JUN.	0.57	0.14	6/04/89
	JUL.	1.51	0.48	7/12/89
	AUG.	1.64	0.55	8/10/89
	SEP.	0.78	0.65	9/20/89
	OCT.	1.39	0.45	10/25/89
	NOV.	0.67	0.39	11/26/89
	DEC.	0.28	0.2	12/10/89
	Total:	13.87	0.8	FEB. '89
1990	JAN.	1.11	0.32	1/14/90
	FEB.	1.31	0.26	2/17/90
	MAR.	1.47	0.68	3/28/90
	APR.	2.19	0.98	4/08/90
	MAY	1.34	0.45	5/30/90
	JUN.	1.07	0.29	6/11/90
	JUL.	1.01	0.26	7/14/90
	AUG.	0.73	0.28	8/11/90
	SEP.	1.21	0.31	9/23/90
	OCT.	1.51	0.98	10/19/90
	NOV.	1.22	0.33	11/01/90
	DEC.	0.74	0.17	12/12/90
	Total:	14.91	0.98	APR/OCT9
1991	JAN.	1.92	1.04	1/15/91
	FEB.	1.06	0.73	2/16/91
	MAR.	2.63	0.6	3/01/91
	APR.	2.41	0.53	4/10/91
	MAY	2.98	0.59	5/14/91
	JUN.	0.94	0.55	6/02/91
	JUL.	1.66	0.99	7/08/91
	AUG.	2.2	0.32	8/04/91
	SEP.	2.04	0.6	9/06/91
	OCT.	1.66	0.45	10/23/91
	NOV.	1.71	0.39	11/17/91
	DEC.	0.62	0.23	12/02/91
	Total:	21.83	1.04	JAN. '91
1992	JAN.	0.91	0.43	1/06/92
	FEB.	2.94	1.1	2/11/92
	MAR.	1.03	0.26	3/26/92
	APR.	0.51	0.18	4/21/92
	MAY	1.65	0.55	5/09/92
	JUN.	0.79	0.22	6/13/92
	JUL.	0.99	0.28	7/12/92
	AUG.	0.43	0.23	8/30/92

YEAR	MONTH	PRECIP. (in.)	DAILY MAX(in)	DATE OF MAXIMUM
	SEP.	0.46	0.26	9/04/92
	OCT.	1.85	0.54	10/30/92
	NOV.	1.77	0.8	11/02/92
	DEC.	1.71	0.3	12/28/92
	Total:	15.04	1.1	FEB. '92
1993	JAN.	3.41	0.52	1/18/93
	FEB.	2.63	0.49	2/19/93
	MAR.	1.88	0.55	3/28/93
	APR.	0.99	0.6	4/05/93
	MAY	2.82	0.82	5/06/93
	JUN.	1.62	0.56	6/07/93
	JUL.	1.33	1	7/03/93
	AUG.	0.53	0.29	8/05/93
	SEP.	0.49	0.29	9/17/93
	OCT.	2.89	0.51	10/15/93
	NOV.	0.81	0.5	11/22/93
	DEC.	0.63	0.38	12/12/93
	Total:	20.03	1	JUL. '93
1994	JAN.	0.73	0.4	1/6/94
	FEB.	2.41	0.6	2/20/94
	MAR.	2.03	0.72	3/10/94
	APR.	2.03	0.32	4/27/94
	MAY	1.49	0.48	5/12/94
	JUN.	0	0	—
	JUL.	0.52	0.3	7/22/94
	AUG.	3.98	0.9	8/12/94
	SEP.	0.75	0.7	9/29/94
	OCT.	2.45	0.7	10/5/94
	NOV.	3.47	0.63	11/2/94
	DEC.	2.55	0.7	12/3/94
	Total:	22.41	0.9	Aug. '94
1995	JAN.	2.22	0.52	1/11/95
	FEB.	1.42	0.5	2/14/95
	MAR.	3.73	0.9	3/11/95
	APR.	4.22	0.9	4/18/95
	MAY	5.33	0.61	5/11/95
	JUN.	2.67	0.53	6/03/95
	JUL.	0.55	0.3	7/03/95
	AUG.	2.65	1.69	8/21/95
	SEP.	0.67	0.4	9/30/95
	OCT.	0.47	0.34	10/22/1995
	NOV.	0.34	0.15	11/26/1995
	DEC.	2.87	1.27	12/30/1995

YEAR	MONTH	PRECIP. (in.)	DAILY MAX(in)	DATE OF MAXIMUM
	Total:	27.14	1.69	AUG. '95
1996	JAN.	4.88	1.3	01/17/1996
	FEB.	3.08	0.66	02/26/1996
	MAR.	3.12	0.7	03/11/1996
	APR.	1.98	0.39	04/19/1996
	MAY	2.15	0.7	05/26/1996
	JUN.	0.19	0.16	06/11/1996
	JUL.	0.48	0.4	07/16/1996
	AUG.	0.08	0.08	08/26/1996
	SEP.	0.82	0.5	09/15/1996
	OCT.	1.94	0.71	10/24/1996
	NOV.	3.87	0.96	11/21/1996
	DEC.	4.49	0.8	12/11/1996
	Total:	27.08	1.3	JAN. '96
1997	JAN.	4.3	0.85	01/25/1997
	FEB.	2.47	0.82	02/27/1997
	MAR.	0.59	0.29	03/02/1997
	APR.	2.65	0.59	04/23/1997
	MAY	0.94	0.39	05/24/1997
	JUN.	1.78	0.38	06/18/1997
	JUL.	0.59	0.21	07/12/1997
	AUG.	2.73	0.71	08/31/1997
	SEP.	3.26	0.97	09/19/1997
	OCT.	1.95	0.51	10/24/1997
	NOV.	2	0.5	11/27/1997
	DEC.			
	Total:	23.26	0.97	SEP. '97
			1.69	
1998	JAN.	4.02	0.7	01/15/1998
	FEB.	6.32	1	02/23/1998

5/28/98 10:10:31 am

Golder Associates
Barrick Mercur Mine North Hydrology

2yr-24hr storm (1.8")

SCS Type II, AMC II

page 1

BASIN SUMMARY

BASIN ID: N1
SCS METHODOLOGY

NAME: North: Basin A+B

TOTAL AREA.....	475.60 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....	TYPE2	PERV	IMP
PRECIPITATION....	1.80 inches	AREA...:	415.60 Acres 60.00 Acres
TIME INTERVAL....	6.00 min	CN....:	60.00 81.00
		TC....:	49.63 min 65.72 min.
ABSTRACTION COEFF:	0.20		
TcReach - Sheet	L: 300.00 ns:0.1300 p2yr: 1.80 s:0.5000		
TcReach - Shallow	L:1500.00 ks:11.00 s:0.5300		
TcReach - Channel	L:4600.00 kc:15.00 s:0.2780		
impTcReach - Sheet	L: 300.00 ns:0.1300 p2yr: 1.80 s:0.3500		
impTcReach - Shallow	L: 600.00 ks:11.00 s:0.3670		
impTcReach - Channel	L:3450.00 kc:15.00 s:0.0050		
PEAK RATE:	12.42 cfs VOL: 3.39 Ac-ft TIME: 762 min		

BASIN ID: N1a
SCS METHODOLOGY

NAME: North: Basin A+B composite

TOTAL AREA.....	475.60 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....	TYPE2	PERV	IMP
PRECIPITATION....	1.80 inches	AREA...:	475.60 Acres 0.00 Acres
TIME INTERVAL....	10.00 min	CN....:	62.60 0.00
		TC....:	49.63 min 0.00 min
ABSTRACTION COEFF:	0.20		
TcReach - Sheet	L: 300.00 ns:0.1300 p2yr: 1.80 s:0.5000		
TcReach - Shallow	L:1500.00 ks:11.00 s:0.5300		
TcReach - Channel	L:4600.00 kc:15.00 s:0.2780		
impTcReach - Sheet	L: 300.00 ns:0.1300 p2yr: 1.80 s:0.3500		
impTcReach - Shallow	L: 600.00 ks:11.00 s:0.3670		
impTcReach - Channel	L:3450.00 kc:15.00 s:0.0050		
PEAK RATE:	3.44 cfs VOL: 2.15 Ac-ft TIME: 830 min		

BASIN ID: N1b
SCS METHODOLOGY

NAME: North: Basin A+B pervious

TOTAL AREA.....	415.60 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....	TYPE2	PERV	IMP
PRECIPITATION....	1.80 inches	AREA...:	415.60 Acres 0.00 Acres
TIME INTERVAL....	10.00 min	CN....:	60.00 0.00
		TC....:	49.65 min 0.00 min
ABSTRACTION COEFF:	0.20		
TcReach - Sheet	L: 300.00 ns:0.1300 p2yr: 1.80 s:0.5000		
TcReach - Shallow	L:1500.00 ks:11.00 s:0.5300		
TcReach - Channel	L:4600.00 kc:15.00 s:0.2780		
impTcReach - Sheet	L: 300.00 ns:0.1300 p2yr: 1.80 s:0.3500		
impTcReach - Shallow	L: 600.00 ks:11.00 s:0.3670		
impTcReach - Channel	L:3450.00 kc:15.00 s:0.0050		
PEAK RATE:	1.28 cfs VOL: 1.03 Ac-ft TIME: 1020 min		

5/28/98 10:10:31 am

Golder Associates

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Barrick Mercur Mine North Hydrology

2yr-24hr storm (1.8")

SCS Type II, AMC II

=====
BASIN SUMMARY

BASIN ID: N1c NAME: North: Basin A+B impervious
 SCS METHODOLOGY
 TOTAL AREA.....: 60.00 Acres BASEFLOWS: 0.00 cfs
 RAINFALL TYPE....: TYPE2 PERV IMP
 PRECIPITATION....: 1.80 inches AREA...: 60.00 Acres 0.00 Acres
 TIME INTERVAL....: 10.00 min CN....: 81.00 0.00
 TC....: 65.72 min 0.00 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.5000

TcReach - Shallow L:1500.00 ks:11.00 s:0.5300

TcReach - Channel L:4600.00 kc:15.00 s:0.2780

impTcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.3500

impTcReach - Shallow L: 600.00 ks:11.00 s:0.3670

impTcReach - Channel L:3450.00 kc:15.00 s:0.0050

PEAK RATE: 12.31 cfs VOL: 2.36 Ac-ft TIME: 770 min

BASIN ID: N1d NAME:

SCS METHODOLOGY

TOTAL AREA.....: 60.00 Acres BASEFLOWS: 0.00 cfs
 RAINFALL TYPE....: TYPE2 PERV IMP
 PRECIPITATION....: 1.80 inches AREA...: 0.00 Acres 60.00 Acres
 TIME INTERVAL....: 10.00 min CN....: 0.00 81.00
 TC....: 0.00 min 65.72 min

ABSTRACTION COEFF: 0.20

PEAK RATE: 12.31 cfs VOL: 2.36 Ac-ft TIME: 770 min

BASIN ID: N2 NAME: North: Tailings Pond

SCS METHODOLOGY

TOTAL AREA.....: 67.30 Acres BASEFLOWS: 0.00 cfs
 RAINFALL TYPE....: TYPE2 PERV IMP
 PRECIPITATION....: 1.80 inches AREA...: 13.80 Acres 53.50 Acres
 TIME INTERVAL....: 6.00 min CN....: 60.00 81.00
 TC....: 16.01 min 72.83 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.5000

TcReach - Shallow L:1500.00 ks:11.00 s:0.5300

TcReach - Channel L:4600.00 kc:15.00 s:0.2780

impTcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.3500

impTcReach - Shallow L: 600.00 ks:11.00 s:0.3670

impTcReach - Channel L:3450.00 kc:15.00 s:0.0050

PEAK RATE: 10.30 cfs VOL: 2.14 Ac-ft TIME: 762 min

5/28/98 10:10:31 am

Golder Associates

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Barrick Mercur Mine North Hydrology

2yr-24hr storm (1.8")

SCS Type II, AMC II

=====
BASIN SUMMARY

BASIN ID: N3

NAME: North: Meadow Canyon

SCS METHODOLOGY

TOTAL AREA.....	932.20 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....	TYPE2	PERV	IMP
PRECIPITATION....	1.80 inches	AREA...:	922.90 Acres 9.30 Acres
TIME INTERVAL....	6.00 min	CN....:	60.00 81.00
		TC....:	33.90 min 16.75 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.5000

TcReach - Shallow L:1500.00 ks:11.00 s:0.5300

TcReach - Channel L:4600.00 kc:15.00 s:0.2780

impTcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.3500

impTcReach - Shallow L: 600.00 ks:11.00 s:0.3670

impTcReach - Channel L:3450.00 kc:15.00 s:0.0050

PEAK RATE: 4.55 cfs VOL: 2.64 Ac-ft TIME: 738 min

BASIN ID: N4

NAME: North: North Central Canyon

SCS METHODOLOGY

TOTAL AREA.....	546.00 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....	TYPE2	PERV	IMP
PRECIPITATION....	1.80 inches	AREA...:	526.00 Acres 20.00 Acres
TIME INTERVAL....	6.00 min	CN....:	60.00 81.00
		TC....:	25.49 min 8.33 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.5000

TcReach - Shallow L:1500.00 ks:11.00 s:0.5300

TcReach - Channel L:4600.00 kc:15.00 s:0.2780

impTcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.3500

impTcReach - Shallow L: 600.00 ks:11.00 s:0.3670

impTcReach - Channel L:3450.00 kc:15.00 s:0.0050

PEAK RATE: 11.48 cfs VOL: 2.08 Ac-ft TIME: 732 min

BASIN ID: N5

NAME: North: Valley Fill #3 East

SCS METHODOLOGY

TOTAL AREA.....	96.20 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....	TYPE2	PERV	IMP
PRECIPITATION....	1.80 inches	AREA...:	55.00 Acres 41.20 Acres
TIME INTERVAL....	6.00 min	CN....:	60.00 81.00
		TC....:	10.80 min 11.19 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.5000

TcReach - Shallow L:1500.00 ks:11.00 s:0.5300

TcReach - Channel L:4600.00 kc:15.00 s:0.2780

impTcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.3500

impTcReach - Shallow L: 600.00 ks:11.00 s:0.3670

impTcReach - Channel L:3450.00 kc:15.00 s:0.0050

PEAK RATE: 21.55 cfs VOL: 1.75 Ac-ft TIME: 732 min

5/28/98 10:10:31 am

Golder Associates

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Barrick Mercur Mine North Hydrology

2yr-24hr storm (1.8")

SCS Type II, AMC II

=====

BASIN SUMMARY

BASIN ID: N6

NAME: North: Phoenix/Rover

SCS METHODOLOGY

TOTAL AREA.....: 691.00 Acres

BASEFLOWS: 0.00 cfs

RAINFALL TYPE....: TYPE2

PERV IMP

PRECIPITATION....: 1.80 inches

AREA...: 437.00 Acres 254.00 Acres

TIME INTERVAL....: 6.00 min

CN....: 60.00 81.00

TC....: 47.76 min 16.40 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.1330

TcReach - Shallow L:5100.00 ks:11.00 s:0.5300

TcReach - Channel L:4600.00 kc:15.00 s:0.2780

impTcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.3500

impTcReach - Shallow L: 600.00 ks:11.00 s:0.3670

impTcReach - Channel L:3450.00 kc:15.00 s:0.0050

PEAK RATE: 126.03 cfs VOL: 11.06 Ac-ft TIME: 738 min

BASIN ID: N7

NAME: North: Lower Tailings Dam

SCS METHODOLOGY

TOTAL AREA.....: 119.00 Acres

BASEFLOWS: 0.00 cfs

RAINFALL TYPE....: TYPE2

PERV IMP

PRECIPITATION....: 1.80 inches

AREA...: 80.40 Acres 38.60 Acres

TIME INTERVAL....: 6.00 min

CN....: 60.00 81.00

TC....: 19.84 min 18.76 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.5000

TcReach - Shallow L:1500.00 ks:11.00 s:0.5300

TcReach - Channel L:4600.00 kc:15.00 s:0.2780

impTcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.3500

impTcReach - Shallow L: 600.00 ks:11.00 s:0.3670

impTcReach - Channel L:3450.00 kc:15.00 s:0.0050

PEAK RATE: 17.98 cfs VOL: 1.71 Ac-ft TIME: 738 min

5/28/98 10:10:31 am

Golder Associates

Barrick Mercur Mine North Hydrology

2yr-24hr storm (1.8")

SCS Type II, AMC II

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HYDROGRAPH SUMMARY

HYD NUM	PEAK RUNOFF RATE cfs	TIME OF PEAK min.	VOLUME OF HYDRO cf\AcFt	Contrib Area Acres
1	11.283	780	147790 cf	475.60
2	18.019	798	240850 cf	542.90
3	18.802	822	355827 cf	1475.10
4	20.841	840	446597 cf	2021.10

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5/28/98 10:11:50 am

Golder Associates

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Barrick Mercur Mine South Hydrology

2yr-24hr storm (1.8")

SCS Type II, AMC II

=====
BASIN SUMMARY

BASIN ID: S1

NAME: South: Basin C

SCS METHODOLOGY

TOTAL AREA.....:	218.30 Acres	BASEFLOWS:	0.00 cfs	
RAINFALL TYPE....:	TYPE2	PERV	IMP	
PRECIPITATION....:	1.80 inches	AREA...:	196.30 Acres	22.00 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00	81.00
		TC....:	20.82 min	42.84 min
ABSTRACTION COEFF:	0.20			
PEAK RATE:	6.19 cfs	VOL:	1.35 Ac-ft	TIME: 750 min

BASIN ID: S2

NAME: South: East Tailings Dam

SCS METHODOLOGY

TOTAL AREA.....:	43.10 Acres	BASEFLOWS:	0.00 cfs	
RAINFALL TYPE....:	TYPE2	PERV	IMP	
PRECIPITATION....:	1.80 inches	AREA...:	21.00 Acres	22.10 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00	81.00
		TC....:	12.87 min	12.87 min
ABSTRACTION COEFF:	0.20			
PEAK RATE:	11.50 cfs	VOL:	0.92 Ac-ft	TIME: 738 min

BASIN ID: S3

NAME: South: North Facilities

SCS METHODOLOGY

TOTAL AREA.....:	40.40 Acres	BASEFLOWS:	0.00 cfs	
RAINFALL TYPE....:	TYPE2	PERV	IMP	
PRECIPITATION....:	1.80 inches	AREA...:	33.60 Acres	6.80 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00	81.00
		TC....:	7.05 min	4.70 min
ABSTRACTION COEFF:	0.20			
impTcReach - Sheet	L: 100.00 ns:0.1300 p2yr: 1.80 s:0.5070			
impTcReach - Shallow	L: 250.00 ks:11.00 s:0.2500			
impTcReach - Channel	L: 150.00 kc:15.00 s:0.0500			
PEAK RATE:	4.06 cfs	VOL:	0.35 Ac-ft	TIME: 732 min

BASIN ID: S4

NAME: South: Facilities

SCS METHODOLOGY

TOTAL AREA.....:	172.90 Acres	BASEFLOWS:	0.00 cfs	
RAINFALL TYPE....:	TYPE2	PERV	IMP	
PRECIPITATION....:	1.80 inches	AREA...:	55.00 Acres	117.90 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00	81.00
		TC....:	30.62 min	11.25 min
ABSTRACTION COEFF:	0.20			
impTcReach - Sheet	L: 100.00 ns:0.1300 p2yr: 1.80 s:0.5070			
impTcReach - Shallow	L: 250.00 ks:11.00 s:0.2500			
impTcReach - Channel	L: 150.00 kc:15.00 s:0.0500			
PEAK RATE:	61.78 cfs	VOL:	4.76 Ac-ft	TIME: 738 min

5/28/98 10:11:50 am

Golder Associates

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Barrick Mercur Mine South Hydrology

2yr-24hr storm (1.8")

SCS Type II, AMC II

=====

BASIN SUMMARY

BASIN ID: S5

NAME: South: Mercur Dump East

SCS METHODOLOGY

TOTAL AREA.....:	78.00 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV	IMP
PRECIPITATION....:	1.80 inches	AREA...:	5.80 Acres 72.20 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00 81.00
		TC....:	16.18 min 29.06 min

ABSTRACTION COEFF: 0.20

impTcReach - Sheet L: 100.00 ns:0.1300 p2yr: 1.80 s:0.5070

impTcReach - Shallow L: 250.00 ks:11.00 s:0.2500

impTcReach - Channel L: 150.00 kc:15.00 s:0.0500

PEAK RATE: 26.49 cfs VOL: 2.85 Ac-ft TIME: 744 min

BASIN ID: S6

NAME: South: Golden Gate East

SCS METHODOLOGY

TOTAL AREA.....:	13.10 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV	IMP
PRECIPITATION....:	1.80 inches	AREA...:	0.00 Acres 13.10 Acres
TIME INTERVAL....:	6.00 min	CN....:	0.00 81.00
		TC....:	0.00 min 9.65 min

ABSTRACTION COEFF: 0.20

impTcReach - Sheet L: 100.00 ns:0.1300 p2yr: 1.80 s:0.5070

impTcReach - Shallow L: 250.00 ks:11.00 s:0.2500

impTcReach - Channel L: 150.00 kc:15.00 s:0.0500

PEAK RATE: 7.24 cfs VOL: 0.51 Ac-ft TIME: 732 min

5/28/98 10:11:50 am

Golder Associates

Barrick Mercur Mine South Hydrology

2yr-24hr storm (1.8")

SCS Type II, AMC II

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HYDROGRAPH SUMMARY

HYD NUM	PEAK RUNOFF RATE cfs	TIME OF PEAK min.	VOLUME OF HYDRO cf\AcFt	Contrib Area Acres
1	5.633	774	58756 cf	218.30
2	10.731	744	98813 cf	261.40
3	10.980	756	113979 cf	301.80
4	63.174	738	321515 cf	474.70
5	86.441	738	445759 cf	552.70
6	85.442	744	468174 cf	565.80

5/27/98 5:27:25 pm

Golder Associates

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Barrick Mercur Mine North Hydrology

10yr-24hr storm (2.6")

SCS Type II, AMC II

=====
BASIN SUMMARY

BASIN ID: N1

NAME: North: Basin A+B

SCS METHODOLOGY

TOTAL AREA.....:	475.60 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV	IMP
PRECIPITATION....:	2.60 inches	AREA...:	415.60 Acres 60.00 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00 81.00
		TC....:	49.63 min 65.72 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.5000
 TcReach - Shallow L:1500.00 ks:11.00 s:0.5300
 TcReach - Channel L:4600.00 kc:15.00 s:0.2780
 TcReach - Channel L:1850.00 kc:15.00 s:0.0050
 impTcReach - Sheet L: 300.00 ns:0.1500 p2yr: 1.80 s:0.3500
 impTcReach - Shallow L: 600.00 ks:11.00 s:0.3670
 impTcReach - Channel L:3450.00 kc:15.00 s:0.0050
 PEAK RATE: 48.51 cfs VOL: 11.83 Ac-ft TIME: 762 min

BASIN ID: N2

NAME: North: Tailings Pond

SCS METHODOLOGY

TOTAL AREA.....:	67.30 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV	IMP
PRECIPITATION....:	2.60 inches	AREA...:	13.80 Acres 53.50 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00 81.00
		TC....:	16.01 min 72.83 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.4070
 TcReach - Shallow L: 400.00 ks:11.00 s:0.5000
 TcReach - Channel L: 900.00 kc:15.00 s:0.0220
 impTcReach - Sheet L: 300.00 ns:0.1500 p2yr: 1.80 s:0.0100
 impTcReach - Shallow L: 900.00 ks:11.00 s:0.0100
 impTcReach - Channel L:1500.00 kc:20.00 s:0.0050
 PEAK RATE: 24.67 cfs VOL: 4.66 Ac-ft TIME: 762 min

BASIN ID: N3

NAME: North: Meadow Canyon

SCS METHODOLOGY

TOTAL AREA.....:	932.20 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV	IMP
PRECIPITATION....:	2.60 inches	AREA...:	922.90 Acres 9.30 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00 81.00
		TC....:	33.90 min 16.75 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.5300
 TcReach - Shallow L:2000.00 ks:11.00 s:0.5800
 TcReach - Channel L:9000.00 kc:15.00 s:0.2000
 impTcReach - Sheet L: 300.00 ns:0.1500 p2yr: 1.80 s:0.1930
 impTcReach - Shallow L:1150.00 ks:11.00 s:0.4300
 impTcReach - Channel L: 250.00 kc:15.00 s:0.0400
 PEAK RATE: 55.70 cfs VOL: 15.94 Ac-ft TIME: 750 min

5/27/98 5:27:25 pm

Golder Associates

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Barrick Mercur Mine North Hydrology

10yr-24hr storm (2.6")

SCS Type II, AMC II

=====
BASIN SUMMARYBASIN ID: N4
SCS METHODOLOGY

NAME: North: North Central Canyon

TOTAL AREA.....:	546.00 Acres	BASEFLOWS:	0.00 cfs	
RAINFALL TYPE....:	TYPE2	PERV	IMP	
PRECIPITATION....:	2.60 inches	AREA...:	526.00 Acres	20.00 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00	81.00
		TC....:	25.49 min	8.33 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.5330

TcReach - Shallow L: 2850.00 ks:11.00 s:0.4910

TcReach - Channel L: 3500.00 kc:15.00 s:0.1090

impTcReach - Channel L: 1500.00 kc:15.00 s:0.0400

PEAK RATE: 48.60 cfs VOL: 10.30 Ac-ft TIME: 738 min

BASIN ID: N5
SCS METHODOLOGY

NAME: North: Valley Fill #3 East

TOTAL AREA.....:	96.20 Acres	BASEFLOWS:	0.00 cfs	
RAINFALL TYPE....:	TYPE2	PERV	IMP	
PRECIPITATION....:	2.60 inches	AREA...:	55.00 Acres	41.20 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00	81.00
		TC....:	10.80 min	11.19 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.85 s:0.4770

TcReach - Shallow L: 700.00 ks:11.00 s:0.5000

TcReach - Channel L: 700.00 kc:15.00 s:0.2640

impTcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.3670

impTcReach - Shallow L: 450.00 ks:11.00 s:0.5560

impTcReach - Channel L: 800.00 kc:15.00 s:0.3440

PEAK RATE: 53.01 cfs VOL: 4.31 Ac-ft TIME: 732 min

BASIN ID: N6
SCS METHODOLOGY

NAME: North: Phoenix/Rover

TOTAL AREA.....:	691.00 Acres	BASEFLOWS:	0.00 cfs	
RAINFALL TYPE....:	TYPE2	PERV	IMP	
PRECIPITATION....:	2.60 inches	AREA...:	437.00 Acres	254.00 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00	81.00
		TC....:	47.76 min	16.40 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.1330

TcReach - Shallow L: 5100.00 ks:11.00 s:0.1800

TcReach - Channel L: 5100.00 kc:15.00 s:0.1194

impTcReach - Channel L: 5100.00 kc:15.00 s:0.1194

PEAK RATE: 293.65 cfs VOL: 28.22 Ac-ft TIME: 738 min

5/27/98 5:27:25 pm

Golder Associates
Barrick Mercur Mine North Hydrology

10yr-24hr storm (2.6")
SCS Type II, AMC II

page 3

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BASIN SUMMARY

BASIN ID: N7

NAME: North: Lower Tailings Dam

SCS METHODOLOGY

TOTAL AREA.....: 119.00 Acres

BASEFLOWS: 0.00 cfs

RAINFALL TYPE....: TYPE2

PERV IMP

PRECIPITATION....: 2.60 inches

AREA...: 80.40 Acres 38.60 Acres

TIME INTERVAL....: 6.00 min

CN....: 60.00 81.00

TC....: 19.84 min 18.76 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.4700

TcReach - Shallow L:1800.00 ks:11.00 s:0.3200

TcReach - Channel L:1650.00 kc:15.00 s:0.0670

impTcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.3300

impTcReach - Shallow L: 930.00 ks:11.00 s:0.3100

impTcReach - Channel L:1650.00 kc:15.00 s:0.0670

PEAK RATE: 46.22 cfs VOL: 4.51 Ac-ft TIME: 738 min

5/27/98 5:27:25 pm

Golder Associates
Barrick Mercur Mine North Hydrology

10yr-24hr storm (2.6")
SCS Type II, AMC II

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HYDROGRAPH SUMMARY

HYD NUM	PEAK RUNOFF RATE cfs	TIME OF PEAK min.	VOLUME OF HYDRO cf\AcFt	Contrib Area Acres
1	46.612	774	515185 cf	475.60
2	68.624	780	717984 cf	542.90
3	109.054	786	1412363 cf	1475.10
4	130.725	792	1860851 cf	2021.10
5	130.715	798	1860849 cf	2021.10
6	133.863	822	2048690 cf	2117.30
7	139.628	822	2245296 cf	2236.30
8	145.393	822	2441902 cf	2355.30

5/27/98 5:29:0 pm

Golder Associates
Barrick Mercur Mine South Hydrology

page 1

10yr-24hr storm (2.6")
SCS Type II, AMC II=====
BASIN SUMMARY

BASIN ID: S1 NAME: South: Basin C

SCS METHODOLOGY

TOTAL AREA.....:	218.30 Acres	BASEFLOWS: 0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV IMP
PRECIPITATION....:	2.60 inches	AREA...: 196.30 Acres 22.00 Acres
TIME INTERVAL....:	6.00 min	CN....: 60.00 81.00
		TC....: 20.82 min 42.84 min .
ABSTRACTION COEFF:	0.20	
TcReach - Sheet	L: 300.00 ns:0.1300 p2yr: 1.80 s:0.3330	
TcReach - Shallow	L: 2150.00 ks:11.00 s:0.4650	
TcReach - Channel	L: 2600.00 kc:15.00 s:0.1737	
impTcReach - Sheet	L: 300.00 ns:0.1300 p2yr: 1.80 s:0.0200	
impTcReach - Shallow	L: 500.00 ks:11.00 s:0.0200	
impTcReach - Channel	L: 600.00 kc:15.00 s:0.0050	
PEAK RATE:	26.73 cfs VOL: 5.05 Ac-ft TIME: 750 min	

BASIN ID: S2 NAME: South: East Tailings Dam

SCS METHODOLOGY

TOTAL AREA.....:	43.10 Acres	BASEFLOWS: 0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV IMP
PRECIPITATION....:	2.60 inches	AREA...: 21.00 Acres 22.10 Acres
TIME INTERVAL....:	6.00 min	CN....: 60.00 81.00
		TC....: 12.87 min 12.87 min
ABSTRACTION COEFF:	0.20	
impTcReach - Sheet	L: 300.00 ns:0.1300 p2yr: 1.80 s:0.2700	
impTcReach - Shallow	L: 500.00 ks:11.00 s:0.1600	
impTcReach - Channel	L: 350.00 kc:20.00 s:0.0750	
PEAK RATE:	27.36 cfs VOL: 2.17 Ac-ft TIME: 738 min	

BASIN ID: S3 NAME: South: North Facilities

SCS METHODOLOGY

TOTAL AREA.....:	40.40 Acres	BASEFLOWS: 0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV IMP
PRECIPITATION....:	2.60 inches	AREA...: 33.60 Acres 6.80 Acres
TIME INTERVAL....:	6.00 min	CN....: 60.00 81.00
		TC....: 7.05 min 4.70 min
ABSTRACTION COEFF:	0.20	
TcReach - Sheet	L: 100.00 ns:0.1500 p2yr: 1.80 s:0.4000	
TcReach - Shallow	L: 500.00 ks:11.00 s:0.3000	
TcReach - Channel	L: 600.00 kc:15.00 s:0.1500	
impTcReach - Sheet	L: 100.00 ns:0.1300 p2yr: 1.80 s:0.5070	
impTcReach - Shallow	L: 250.00 ks:11.00 s:0.2500	
impTcReach - Channel	L: 150.00 kc:15.00 s:0.0500	
PEAK RATE:	11.92 cfs VOL: 1.11 Ac-ft TIME: 732 min	

5/27/98 5:29:0 pm

Golder Associates
Barrick Mercur Mine South Hydrology

page 2

10yr-24hr storm (2.6")
SCS Type II, AMC II

BASIN SUMMARY

BASIN ID: S4	NAME: South: Facilities		
SCS METHODOLOGY			
TOTAL AREA.....	172.90 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....	TYPE2	PERV	IMP
PRECIPITATION....	2.60 inches	AREA...:	55.00 Acres 117.90 Acres
TIME INTERVAL....	6.00 min	CN....:	60.00 81.00
		TC....:	30.62 min 11.25 min
ABSTRACTION COEFF:	0.20		
TcReach - Sheet	L: 300.00 ns:0.1300 p2yr: 1.80 s:0.1330		
TcReach - Shallow	L:1900.00 ks:11.00 s:0.1210		
TcReach - Channel	L:2950.00 kc:15.00 s:0.1270		
impTcReach - Shallow	L: 650.00 ks:11.00 s:0.2310		
impTcReach - Channel	L:2950.00 kc:15.00 s:0.1270		
PEAK RATE:	140.86 cfs VOL: 10.66 Ac-ft TIME: 732 min		
BASIN ID: S5		NAME: South: Mercur Dump East	
SCS METHODOLOGY			
TOTAL AREA.....	78.00 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....	TYPE2	PERV	IMP
PRECIPITATION....	2.60 inches	AREA...:	5.80 Acres 72.20 Acres
TIME INTERVAL....	6.00 min	CN....:	61.00 81.00
		TC....:	16.18 min 29.06 min
ABSTRACTION COEFF:	0.20		
TcReach - Sheet	L: 300.00 ns:0.1300 p2yr: 1.80 s:0.2500		
TcReach - Shallow	L: 680.00 ks:11.00 s:0.2940		
TcReach - Channel	L:1320.00 kc:15.00 s:0.1300		
impTcReach - Sheet	L: 200.00 ns:0.1300 p2yr: 1.80 s:0.6000		
impTcReach - Channel	L:3900.00 kc:15.00 s:0.0330		
PEAK RATE:	61.34 cfs VOL: 6.09 Ac-ft TIME: 744 min		
BASIN ID: S6		NAME: South: Golden Gate East	
SCS METHODOLOGY			
TOTAL AREA.....	13.10 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....	TYPE2	PERV	IMP
PRECIPITATION....	2.60 inches	AREA...:	0.00 Acres 13.10 Acres
TIME INTERVAL....	6.00 min	CN....:	0.00 81.00
		TC....:	0.00 min 9.65 min
ABSTRACTION COEFF:	0.20		
impTcReach - Sheet	L: 200.00 ns:0.1300 p2yr: 1.80 s:0.3000		
impTcReach - Shallow	L: 550.00 ks:11.00 s:0.3000		
impTcReach - Channel	L: 300.00 kc:15.00 s:0.0700		
PEAK RATE:	16.32 cfs VOL: 1.08 Ac-ft TIME: 732 min		

5/27/98 5:29:0 pm

Golder Associates
Barrick Mercur Mine South Hydrology

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10yr-24hr storm (2.6")
SCS Type II, AMC II

=====

BASIN SUMMARY

BASIN ID: S7 NAME: South:

SCS METHODOLOGY

TOTAL AREA.....:	0.00 Acres	BASEFLOWS: 0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV IMP
PRECIPITATION....:	2.60 inches	AREA...: 0.00 Acres 0.00 Acres
TIME INTERVAL....:	6.00 min	CN....: 60.00 81.00
		TC....: 0.00 min 0.00 min

ABSTRACTION COEFF: 0.20

impTcReach - Channel L:1850.00 kc:15.00 s:0.0760

PEAK RATE: 0.00 cfs VOL: 0.00 Ac-ft TIME: 0 min

5/27/98 5:29:0 pm

Golder Associates
Barrick Mercur Mine South Hydrology

10yr-24hr storm (2.6")
SCS Type II, AMC II

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HYDROGRAPH SUMMARY

HYD NUM	PEAK RUNOFF RATE cfs	TIME OF PEAK min.	VOLUME OF HYDRO cf\AcFt	Contrib Area Acres
1	25.809	762	219858 cf	218.30
2	25.047	768	219869 cf	218.30
3	29.425	774	314512 cf	261.40
4	33.136	750	362835 cf	301.80
5	31.315	750	362831 cf	301.80
6	146.604	738	827243 cf	474.70
7	57.520	750	265095 cf	78.00
8	181.548	738	1092338 cf	552.70

5/28/98 10:11:3 am

Golder Associates
Barrick Mercur Mine North Hydrology

50yr-24hr storm (3.4")

SCS Type II, AMC II

page 1

BASIN SUMMARY

BASIN ID: N1

NAME: North: Basin A+B

SCS METHODOLOGY

TOTAL AREA.....:	475.60 Acres	BASEFLOWS: 0.00 cfs	
RAINFALL TYPE....:	TYPE2	PERV	IMP
PRECIPITATION....:	3.40 inches	AREA...: 415.60 Acres	60.00 Acres
TIME INTERVAL....:	6.00 min	CN....: 60.00	81.00
		TC....: 49.63 min	65.72 min
ABSTRACTION COEFF:	0.20		
PEAK RATE:	126.65 cfs	VOL: 24.57 Ac-ft	TIME: 756 min

BASIN ID: N2

NAME: North: Tailings Pond

SCS METHODOLOGY

TOTAL AREA.....:	67.30 Acres	BASEFLOWS: 0.00 cfs	
RAINFALL TYPE....:	TYPE2	PERV	IMP
PRECIPITATION....:	3.40 inches	AREA...: 13.80 Acres	53.50 Acres
TIME INTERVAL....:	6.00 min	CN....: 60.00	81.00
		TC....: 16.01 min	72.83 min
ABSTRACTION COEFF:	0.20		
PEAK RATE:	41.51 cfs	VOL: 7.66 Ac-ft	TIME: 756 min

BASIN ID: N3

NAME: North: Meadow Canyon

SCS METHODOLOGY

TOTAL AREA.....:	932.20 Acres	BASEFLOWS: 0.00 cfs	
RAINFALL TYPE....:	TYPE2	PERV	IMP
PRECIPITATION....:	3.40 inches	AREA...: 922.90 Acres	9.30 Acres
TIME INTERVAL....:	6.00 min	CN....: 60.00	81.00
		TC....: 33.90 min	16.75 min
ABSTRACTION COEFF:	0.20		
PEAK RATE:	230.23 cfs	VOL: 37.98 Ac-ft	TIME: 750 min

BASIN ID: N4

NAME: North: North Central Canyon

SCS METHODOLOGY

TOTAL AREA.....:	546.00 Acres	BASEFLOWS: 0.00 cfs	
RAINFALL TYPE....:	TYPE2	PERV	IMP
PRECIPITATION....:	3.40 inches	AREA...: 526.00 Acres	20.00 Acres
TIME INTERVAL....:	6.00 min	CN....: 60.00	81.00
		TC....: 25.49 min	8.33 min
ABSTRACTION COEFF:	0.20		
PEAK RATE:	170.08 cfs	VOL: 23.59 Ac-ft	TIME: 738 min

5/28/98 10:11:3 am

Golder Associates

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Barrick Mercur Mine North Hydrology

50yr-24hr storm (3.4")

SCS Type II, AMC II

=====

BASIN SUMMARY

BASIN ID: N5 NAME: North: Valley Fill #3 East

SCS METHODOLOGY

TOTAL AREA.....: 96.20 Acres BASEFLOWS: 0.00 cfs

RAINFALL TYPE....: TYPE2 PERV IMP

PRECIPITATION....: 3.40 inches AREA...: 55.00 Acres 41.20 Acres

TIME INTERVAL....: 6.00 min CN....: 60.00 81.00

TC....: 10.80 min 11.19 min

ABSTRACTION COEFF: 0.20

PEAK RATE: 100.99 cfs VOL: 7.66 Ac-ft TIME: 732 min

BASIN ID: N6 NAME: North: Phoenix/Rover

SCS METHODOLOGY

TOTAL AREA.....: 691.00 Acres BASEFLOWS: 0.00 cfs

RAINFALL TYPE....: TYPE2 PERV IMP

PRECIPITATION....: 3.40 inches AREA...: 437.00 Acres 254.00 Acres

TIME INTERVAL....: 6.00 min CN....: 60.00 81.00

TC....: 47.76 min 16.40 min

ABSTRACTION COEFF: 0.20

PEAK RATE: 508.39 cfs VOL: 51.17 Ac-ft TIME: 738 min

BASIN ID: N7 NAME: North: Lower Tailings Dam

SCS METHODOLOGY

TOTAL AREA.....: 119.00 Acres BASEFLOWS: 0.00 cfs

RAINFALL TYPE....: TYPE2 PERV IMP

PRECIPITATION....: 3.40 inches AREA...: 80.40 Acres 38.60 Acres

TIME INTERVAL....: 6.00 min CN....: 60.00 81.00

TC....: 19.84 min 18.76 min

ABSTRACTION COEFF: 0.20

PEAK RATE: 93.26 cfs VOL: 8.33 Ac-ft TIME: 738 min

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Golder Associates

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Barrick Mercur Mine North Hydrology

50yr-24hr storm (3.4")

SCS Type II, AMC II

=====

HYDROGRAPH SUMMARY

HYD NUM	PEAK RUNOFF RATE cfs	TIME OF PEAK min.	VOLUME OF HYDRO cf\AcFt	Contrib Area Acres
1	124.015	768	1070339 cf	475.60
2	160.928	768	1404014 cf	542.90
3	328.599	768	3058228 cf	1475.10
4	414.833	768	4085913 cf	2021.10

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5/28/98 10:12:12 am

Golder Associates

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Barrick Mercur Mine South Hydrology

50yr-24hr storm (3.4")

SCS Type II, AMC II

=====
BASIN SUMMARY

BASIN ID: S1 NAME: South: Basin C
 SCS METHODOLOGY

TOTAL AREA.....:	218.30 Acres	BASEFLOWS:	0.00 cfs	
RAINFALL TYPE....:	TYPE2	PERV	IMP	
PRECIPITATION....:	3.40 inches	AREA...:	196.30 Acres	22.00 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00	81.00
		TC....:	20.82 min	42.84 min

ABSTRACTION COEFF: 0.20

PEAK RATE: 81.59 cfs VOL: 10.74 Ac-ft TIME: 744 min

BASIN ID: S2 NAME: South: East Tailings Dam
 SCS METHODOLOGY

TOTAL AREA.....:	43.10 Acres	BASEFLOWS:	0.00 cfs	
RAINFALL TYPE....:	TYPE2	PERV	IMP	
PRECIPITATION....:	3.40 inches	AREA...:	21.00 Acres	22.10 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00	81.00
		TC....:	12.87 min	12.87 min

ABSTRACTION COEFF: 0.20

PEAK RATE: 49.96 cfs VOL: 3.77 Ac-ft TIME: 738 min

BASIN ID: S3 NAME: South: North Facilities
 SCS METHODOLOGY

TOTAL AREA.....:	40.40 Acres	BASEFLOWS:	0.00 cfs	
RAINFALL TYPE....:	TYPE2	PERV	IMP	
PRECIPITATION....:	3.40 inches	AREA...:	33.60 Acres	6.80 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00	81.00
		TC....:	7.05 min	5.00 min

ABSTRACTION COEFF: 0.20

PEAK RATE: 29.41 cfs VOL: 2.24 Ac-ft TIME: 732 min

BASIN ID: S4 NAME: South: Facilities
 SCS METHODOLOGY

TOTAL AREA.....:	172.90 Acres	BASEFLOWS:	0.00 cfs	
RAINFALL TYPE....:	TYPE2	PERV	IMP	
PRECIPITATION....:	3.40 inches	AREA...:	55.00 Acres	117.90 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00	81.00
		TC....:	30.62 min	11.25 min

ABSTRACTION COEFF: 0.20

PEAK RATE: 234.78 cfs VOL: 17.85 Ac-ft TIME: 738 min

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Golder Associates

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Barrick Mercur Mine South Hydrology

50yr-24hr storm (3.4")

SCS Type II, AMC II

=====

BASIN SUMMARY

BASIN ID: S5	NAME: South: Mercur Dump East	
SCS METHODOLOGY		
TOTAL AREA.....:	78.00 Acres	BASEFLOWS: 0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV IMP
PRECIPITATION....:	3.40 inches	AREA...: 5.80 Acres 72.20 Acres
TIME INTERVAL....:	6.00 min	CN....: 60.00 81.00
		TC....: 16.18 min 29.06 min
ABSTRACTION COEFF:	0.20	
PEAK RATE: 101.50 cfs VOL:	9.83 Ac-ft	TIME: 744 min
BASIN ID: S6	NAME: South: Golden Gate East	
SCS METHODOLOGY		
TOTAL AREA.....:	13.10 Acres	BASEFLOWS: 0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV IMP
PRECIPITATION....:	3.40 inches	AREA...: 0.00 Acres 13.10 Acres
TIME INTERVAL....:	6.00 min	CN....: 0.00 81.00
		TC....: 0.00 min 9.65 min
ABSTRACTION COEFF:	0.20	
PEAK RATE: 26.56 cfs VOL:	1.74 Ac-ft	TIME: 732 min

5/28/98 10:12:12 am

Golder Associates

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Barrick Mercur Mine South Hydrology

50yr-24hr storm (3.4")

SCS Type II, AMC II

=====

HYDROGRAPH SUMMARY

HYD NUM	PEAK RUNOFF RATE cfs	TIME OF PEAK min.	VOLUME OF HYDRO cf\AcFt	Contrib Area Acres
1	75.330	750	467820 cf	218.30
2	93.449	750	632138 cf	261.40
3	99.128	750	729477 cf	301.80
4	300.788	738	1507096 cf	474.70
5	394.973	738	1935320 cf	552.70
6	392.530	738	2011150 cf	565.80

5/28/98 10:11:25 am

Golder Associates
Barrick Mercur Mine North Hydrology

100yr-24hr storm (3.8")

SCS Type II, AMC II

page 1

BASIN SUMMARY

BASIN ID: N1

NAME: North: Basin A+B

SCS METHODOLOGY

TOTAL AREA.....:	475.60 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV	IMP
PRECIPITATION....:	2.68 inches	AREA...:	415.60 Acres 60.00 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00 81.00
		TC....:	49.63 min 65.72 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.5000

TcReach - Shallow L:1500.00 ks:11.00 s:0.5300

TcReach - Channel L:4600.00 kc:15.00 s:0.2780

TcReach - Channel L:1850.00 kc:15.00 s:0.0050

impTcReach - Sheet L: 300.00 ns:0.1500 p2yr: 1.80 s:0.3500

impTcReach - Shallow L: 600.00 ks:11.00 s:0.3670

impTcReach - Channel L:3450.00 kc:15.00 s:0.0050

PEAK RATE: 54.56 cfs VOL: 12.93 Ac-ft TIME: 762 min

BASIN ID: N2

NAME: North: Tailings Pond

SCS METHODOLOGY

TOTAL AREA.....:	67.30 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV	IMP
PRECIPITATION....:	3.80 inches	AREA...:	13.80 Acres 53.50 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00 81.00
		TC....:	16.01 min 72.83 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.4070

TcReach - Shallow L: 400.00 ks:11.00 s:0.5000

TcReach - Channel L: 900.00 kc:15.00 s:0.0220

impTcReach - Sheet L: 300.00 ns:0.1500 p2yr: 1.80 s:0.0100

impTcReach - Shallow L: 900.00 ks:11.00 s:0.0100

impTcReach - Channel L:1500.00 kc:20.00 s:0.0050

PEAK RATE: 50.70 cfs VOL: 9.29 Ac-ft TIME: 756 min

BASIN ID: N3

NAME: North: Meadow Canyon

SCS METHODOLOGY

TOTAL AREA.....:	932.20 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV	IMP
PRECIPITATION....:	3.80 inches	AREA...:	922.90 Acres 9.30 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00 81.00
		TC....:	33.90 min 16.75 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.5300

TcReach - Shallow L:2000.00 ks:11.00 s:0.5800

TcReach - Channel L:9000.00 kc:15.00 s:0.2000

impTcReach - Sheet L: 300.00 ns:0.1500 p2yr: 1.80 s:0.1930

impTcReach - Shallow L:1150.00 ks:11.00 s:0.4300

impTcReach - Channel L: 250.00 kc:15.00 s:0.0400

PEAK RATE: 353.03 cfs VOL: 51.55 Ac-ft TIME: 750 min

5/28/98 10:11:25 am

Golder Associates

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Barrick Mercur Mine North Hydrology

100yr-24hr storm (3.8")

SCS Type II, AMC II

=====
BASIN SUMMARY

BASIN ID: N4

NAME: North: North Central Canyon

SCS METHODOLOGY

TOTAL AREA.....:	546.00 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV	IMP
PRECIPITATION....:	3.80 inches	AREA...:	526.00 Acres 20.00 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00 81.00
		TC....:	25.49 min 8.33 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.5330

TcReach - Shallow L: 2850.00 ks:11.00 s:0.4910

TcReach - Channel L: 3500.00 kc:15.00 s:0.1090

impTcReach - Channel L: 1500.00 kc:15.00 s:0.0400

PEAK RATE: 256.09 cfs VOL: 31.72 Ac-ft TIME: 738 min

BASIN ID: N5

NAME: North: Valley Fill #3 East

SCS METHODOLOGY

TOTAL AREA.....:	96.20 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV	IMP
PRECIPITATION....:	3.80 inches	AREA...:	55.00 Acres 41.20 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00 81.00
		TC....:	10.80 min 11.19 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.85 s:0.4770

TcReach - Shallow L: 700.00 ks:11.00 s:0.5000

TcReach - Channel L: 700.00 kc:15.00 s:0.2640

impTcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.3670

impTcReach - Shallow L: 450.00 ks:11.00 s:0.5560

impTcReach - Channel L: 800.00 kc:15.00 s:0.3440

PEAK RATE: 129.65 cfs VOL: 9.55 Ac-ft TIME: 732 min

BASIN ID: N6

NAME: North: Phoenix/Rover

SCS METHODOLOGY

TOTAL AREA.....:	691.00 Acres	BASEFLOWS:	0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV	IMP
PRECIPITATION....:	3.80 inches	AREA...:	437.00 Acres 254.00 Acres
TIME INTERVAL....:	6.00 min	CN....:	60.00 81.00
		TC....:	47.76 min 16.40 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.1330

TcReach - Shallow L: 5100.00 ks:11.00 s:0.1800

TcReach - Channel L: 5100.00 kc:15.00 s:0.1194

impTcReach - Channel L: 5100.00 kc:15.00 s:0.1194

PEAK RATE: 628.83 cfs VOL: 64.26 Ac-ft TIME: 738 min

5/28/98 10:11:25 am

Golder Associates

Barrick Mercur Mine North Hydrology

100yr-24hr storm (3.8")

SCS Type II, AMC II

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BASIN SUMMARY

BASIN ID: N7

NAME: North: Lower Tailings Dam

SCS METHODOLOGY

TOTAL AREA.....: 119.00 Acres

BASEFLOWS: 0.00 cfs

RAINFALL TYPE....: TYPE2

PERV IMP

PRECIPITATION....: 3.80 inches

AREA...: 80.40 Acres 38.60 Acres

TIME INTERVAL....: 6.00 min

CN....: 60.00 81.00

TC....: 19.84 min 18.76 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.4700

TcReach - Shallow L:1800.00 ks:11.00 s:0.3200

TcReach - Channel L:1650.00 kc:15.00 s:0.0670

impTcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.3300

impTcReach - Shallow L: 930.00 ks:11.00 s:0.3100

impTcReach - Channel L:1650.00 kc:15.00 s:0.0670

PEAK RATE: 122.23 cfs VOL: 10.52 Ac-ft TIME: 738 min

5/28/98 10:11:25 am

Golder Associates

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Barrick Mercur Mine North Hydrology

100yr-24hr storm (3.8")

SCS Type II, AMC II

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HYDROGRAPH SUMMARY

HYD NUM	PEAK RUNOFF RATE cfs	TIME OF PEAK min.	VOLUME OF HYDRO cf\AcFt	Contrib Area Acres
1	172.837	768	1400138 cf	475.60
2	219.395	768	1804648 cf	542.90
3	492.226	762	4050355 cf	1475.10
4	623.206	762	5432103 cf	2021.10
5	129.646	732	416179 cf	96.20
6	209.500	738	1383909 cf	468.80
7	109.763	744	458092 cf	119.00

5/28/98 10:12:33 am

Golder Associates
Barrick Mercur Mine South Hydrology100yr-24hr storm (3.8")
SCS Type II, AMC II

page 1

=====
BASIN SUMMARY

BASIN ID: S1	NAME: South: Basin C	
SCS METHODOLOGY		
TOTAL AREA.....:	218.30 Acres	BASEFLOWS: 0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV IMP
PRECIPITATION....:	3.80 inches	AREA...: 196.30 Acres 22.00 Acres
TIME INTERVAL....:	6.00 min	CN....: 60.00 81.00
		TC....: 20.82 min 42.84 min
ABSTRACTION COEFF:	0.20	
TcReach - Sheet	L: 300.00 ns:0.1300 p2yr: 1.80 s:0.3330	
TcReach - Shallow	L: 2150.00 ks:11.00 s:0.4650	
TcReach - Channel	L: 2600.00 kc:15.00 s:0.1737	
impTcReach - Sheet	L: 300.00 ns:0.1300 p2yr: 1.80 s:0.0200	
impTcReach - Shallow	L: 500.00 ks:11.00 s:0.0200	
impTcReach - Channel	L: 600.00 kc:15.00 s:0.0050	
PEAK RATE:	119.29 cfs VOL: 14.16 Ac-ft TIME: 738 min	
BASIN ID: S2 NAME: South: East Tailings Dam		
SCS METHODOLOGY		
TOTAL AREA.....:	43.10 Acres	BASEFLOWS: 0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV IMP
PRECIPITATION....:	3.80 inches	AREA...: 21.00 Acres 22.10 Acres
TIME INTERVAL....:	6.00 min	CN....: 60.00 81.00
		TC....: 12.87 min 12.87 min
ABSTRACTION COEFF:	0.20	
impTcReach - Sheet	L: 300.00 ns:0.1300 p2yr: 1.80 s:0.2700	
impTcReach - Shallow	L: 500.00 ks:11.00 s:0.1600	
impTcReach - Channel	L: 350.00 kc:20.00 s:0.0750	
PEAK RATE:	62.92 cfs VOL: 4.67 Ac-ft TIME: 738 min	
BASIN ID: S3 NAME: South: North Facilities		
SCS METHODOLOGY		
TOTAL AREA.....:	40.40 Acres	BASEFLOWS: 0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV IMP
PRECIPITATION....:	3.80 inches	AREA...: 33.60 Acres 6.80 Acres
TIME INTERVAL....:	6.00 min	CN....: 60.00 81.00
		TC....: 7.05 min 4.70 min
ABSTRACTION COEFF:	0.20	
TcReach - Sheet	L: 100.00 ns:0.1500 p2yr: 1.80 s:0.4000	
TcReach - Shallow	L: 500.00 ks:11.00 s:0.3000	
TcReach - Channel	L: 600.00 kc:15.00 s:0.1500	
impTcReach - Sheet	L: 100.00 ns:0.1300 p2yr: 1.80 s:0.5070	
impTcReach - Shallow	L: 250.00 ks:11.00 s:0.2500	
impTcReach - Channel	L: 150.00 kc:15.00 s:0.0500	
PEAK RATE:	40.86 cfs VOL: 2.90 Ac-ft TIME: 732 min	

5/28/98 10:12:33 am

Golder Associates

page 2

Barrick Mercur Mine South Hydrology

100yr-24hr storm (3.8")

SCS Type II, AMC II

=====

BASIN SUMMARY

BASIN ID: S4

NAME: South: Facilities

SCS METHODOLOGY

TOTAL AREA.....: 172.90 Acres

BASEFLOWS: 0.00 cfs

RAINFALL TYPE....: TYPE2

PERV IMP

PRECIPITATION....: 3.80 inches

AREA...: 55.00 Acres 117.90 Acres

TIME INTERVAL....: 6.00 min

CN....: 60.00 81.00

TC....: 30.62 min 11.25 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.1330

TcReach - Shallow L: 1900.00 ks:11.00 s:0.1210

TcReach - Channel L: 2950.00 kc:15.00 s:0.1270

impTcReach - Shallow L: 650.00 ks:11.00 s:0.2310

impTcReach - Channel L: 2950.00 kc:15.00 s:0.1270

PEAK RATE: 285.63 cfs VOL: 21.80 Ac-ft TIME: 738 min

BASIN ID: S5

NAME: South: Mercur Dump East

SCS METHODOLOGY

TOTAL AREA.....: 78.00 Acres

BASEFLOWS: 0.00 cfs

RAINFALL TYPE....: TYPE2

PERV IMP

PRECIPITATION....: 3.80 inches

AREA...: 5.80 Acres 72.20 Acres

TIME INTERVAL....: 6.00 min

CN....: 61.00 81.00

TC....: 16.18 min 29.06 min

ABSTRACTION COEFF: 0.20

TcReach - Sheet L: 300.00 ns:0.1300 p2yr: 1.80 s:0.2500

TcReach - Shallow L: 680.00 ks:11.00 s:0.2940

TcReach - Channel L: 1320.00 kc:15.00 s:0.1300

impTcReach - Sheet L: 200.00 ns:0.1300 p2yr: 1.80 s:0.6000

impTcReach - Channel L: 3900.00 kc:15.00 s:0.0330

PEAK RATE: 123.15 cfs VOL: 11.86 Ac-ft TIME: 744 min

BASIN ID: S6

NAME: South: Golden Gate East

SCS METHODOLOGY

TOTAL AREA.....: 13.10 Acres

BASEFLOWS: 0.00 cfs

RAINFALL TYPE....: TYPE2

PERV IMP

PRECIPITATION....: 3.80 inches

AREA...: 0.00 Acres 13.10 Acres

TIME INTERVAL....: 6.00 min

CN....: 0.00 81.00

TC....: 0.00 min 9.65 min

ABSTRACTION COEFF: 0.20

impTcReach - Sheet L: 200.00 ns:0.1300 p2yr: 1.80 s:0.3000

impTcReach - Shallow L: 550.00 ks:11.00 s:0.3000

impTcReach - Channel L: 300.00 kc:15.00 s:0.0700

PEAK RATE: 31.92 cfs VOL: 2.09 Ac-ft TIME: 732 min

5/28/98 10:12:33 am

Golder Associates

page 3

Barrick Mercur Mine South Hydrology

100yr-24hr storm (3.8")

SCS Type II, AMC II

=====

BASIN SUMMARY

BASIN ID: S7

NAME: South:

SCS METHODOLOGY

TOTAL AREA.....:	0.00 Acres	BASEFLOWS: 0.00 cfs
RAINFALL TYPE....:	TYPE2	PERV IMP
PRECIPITATION....:	3.80 inches	AREA...: 0.00 Acres 0.00 Acres
TIME INTERVAL....:	6.00 min	CN....: 0.00 81.00
		TC....: 0.00 min 0.00 min

ABSTRACTION COEFF: 0.20

impTcReach - Channel L:1850.00 kc:15.00 s:0.0760

PEAK RATE: 0.00 cfs VOL: 0.00 Ac-ft TIME: 0 min

5/28/98 10:12:33 am

Golder Associates

page 4

Barrick Mercur Mine South Hydrology

100yr-24hr storm (3.8")

SCS Type II, AMC II

=====

HYDROGRAPH SUMMARY

HYD NUM	PEAK RUNOFF RATE cfs	TIME OF PEAK min.	VOLUME OF HYDRO cf\AcFt	Contrib Area Acres
1	111.625	750	616749 cf	218.30
2	133.147	750	820055 cf	261.40
3	138.784	756	946301 cf	301.80
4	374.345	738	1895696 cf	474.70
5	489.630	738	2412447 cf	552.70
6	492.422	738	2503518 cf	565.80
7	114.301	756	516751 cf	78.00

LEVEL II: THE MORPHOLOGICAL DESCRIPTION

TABLE 5-3. Reference reach field data form for stream classification.

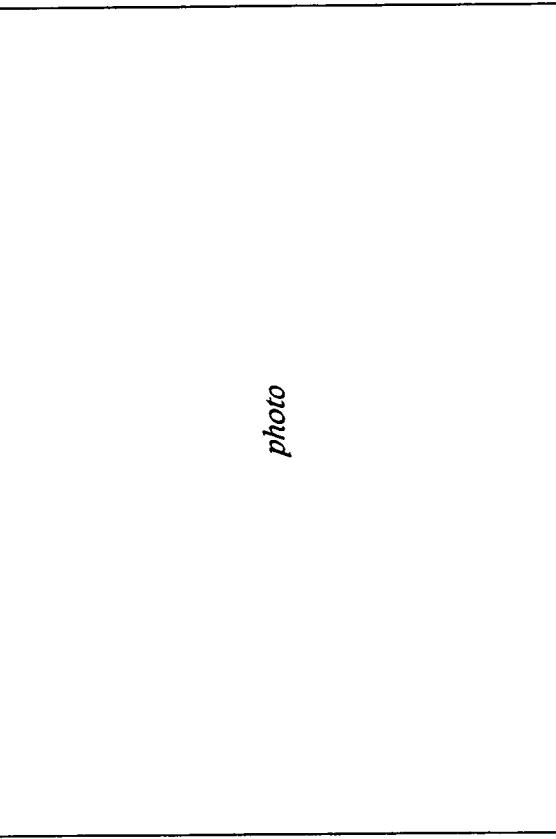
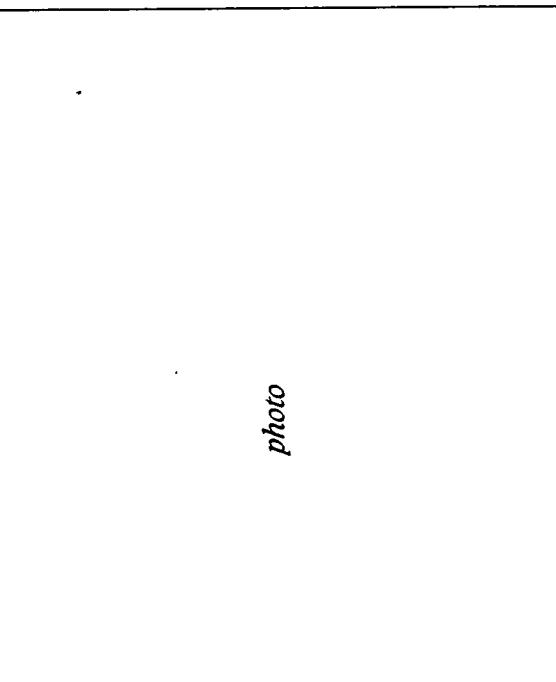
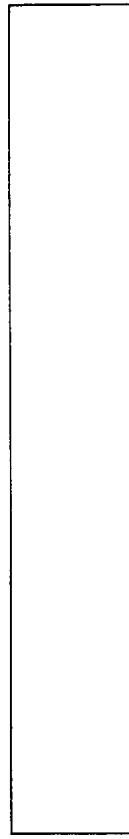
REFERENCE REACH FIELD FORM										
STREAM CHANNEL CLASSIFICATION LEVEL II										
STREAM NAME:	<u>Hercus Canyon</u>									
OBSERVERS:	<u>Tsu</u>									
LOCATION:	<u>22490N, 17840E</u>									
STREAM TYPE: <u>A4</u>										
DRAINAGE AREA:	<u>5.5 mi.</u>									
BASIN NAME:	<u>Mercus</u>									
DATE:	<u>4/9/98</u>									
Twp.	<u>6 S</u>									
Rge.	<u>3W</u>									
Sec.	<u>7</u>									
Qtr.	<u>NW</u>									
Bankfull WIDTH	<u>7.5</u>	Ft. (W _{bkf})	Bankfull MAX> DEPTH	<u>1.5</u>	Ft. (d _{max})	Channel SLOPE	<u>0.07</u>	Ft/Ft	<u>7</u>	%
Bankfull Mean DEPTH	<u>1.2</u>	Ft. (d _{bkf})	Flood Prone Area WIDTH	<u>11</u>	Ft. (W _{fp})	Valley SLOPE	<u>0.07</u>	Ft/Ft	<u>7</u>	%
WIDTH/DEPTH Ratio	<u>6.25</u>		ENTRENCHMENT Ratio	<u>1.47</u>		SINUOSITY (Stream Dist/Valley Dist.)	<u>1</u>			
Channel MATERIALS: (Pebble Count)	D34: <u>12.7</u> mm	D50: <u>9.0</u> mm	D84: <u>8.9</u> mm	D95: <u>200</u> mm						
										
										
										
										
<i>photo</i>										
<i>photo</i>										

Photo-1

Surveyed channel section, lower Mercur Canyon, view downstream (east). Measured channel gradient 7.0 percent.

Photo-2

Surveyed channel section, lower Mercur Canyon, view upstream (west). Photo shows three step structures, similar to the rock vortex weirs applied in the diversion channel design, and intervening pools. Steps are two to three feet high and are spaced twenty to fifty feet apart.

Photo-3

Surveyed channel section, lower Mercur Canyon. Channel bed material comprising step structure.

Photo-4

Surveyed channel section, lower Mercur Canyon. Channel bed material comprising pools.

Photo 1

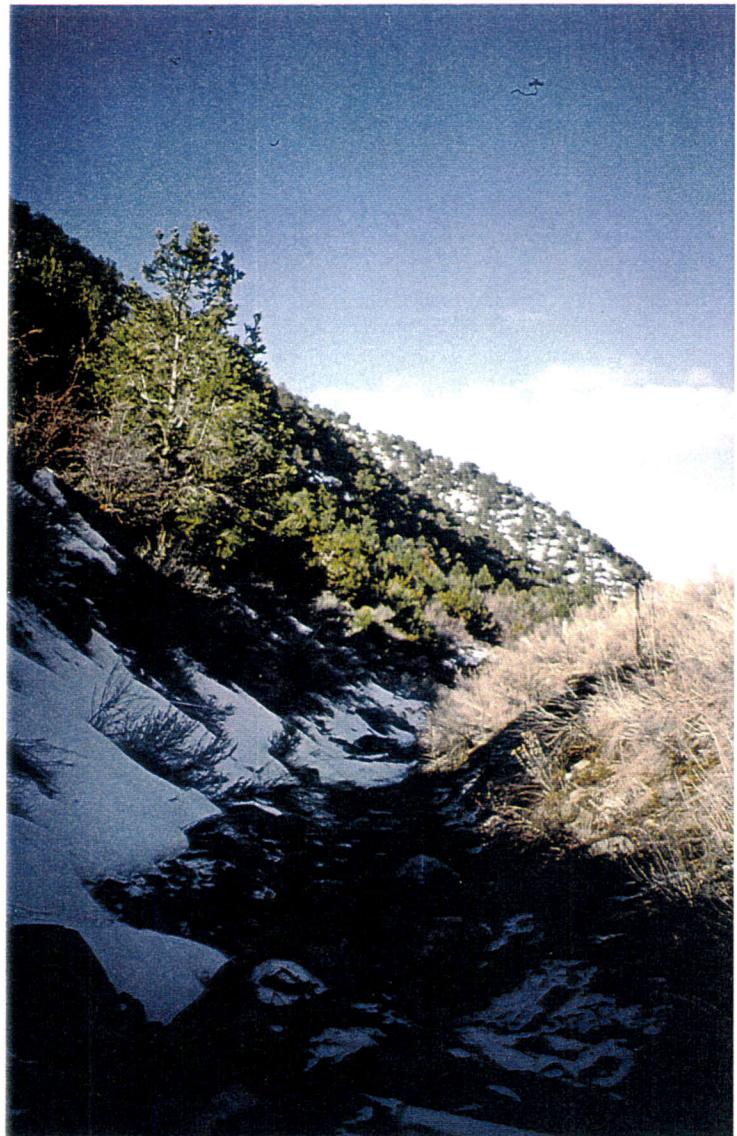


Photo 2



Photo 3



Photo 4

Cross Section

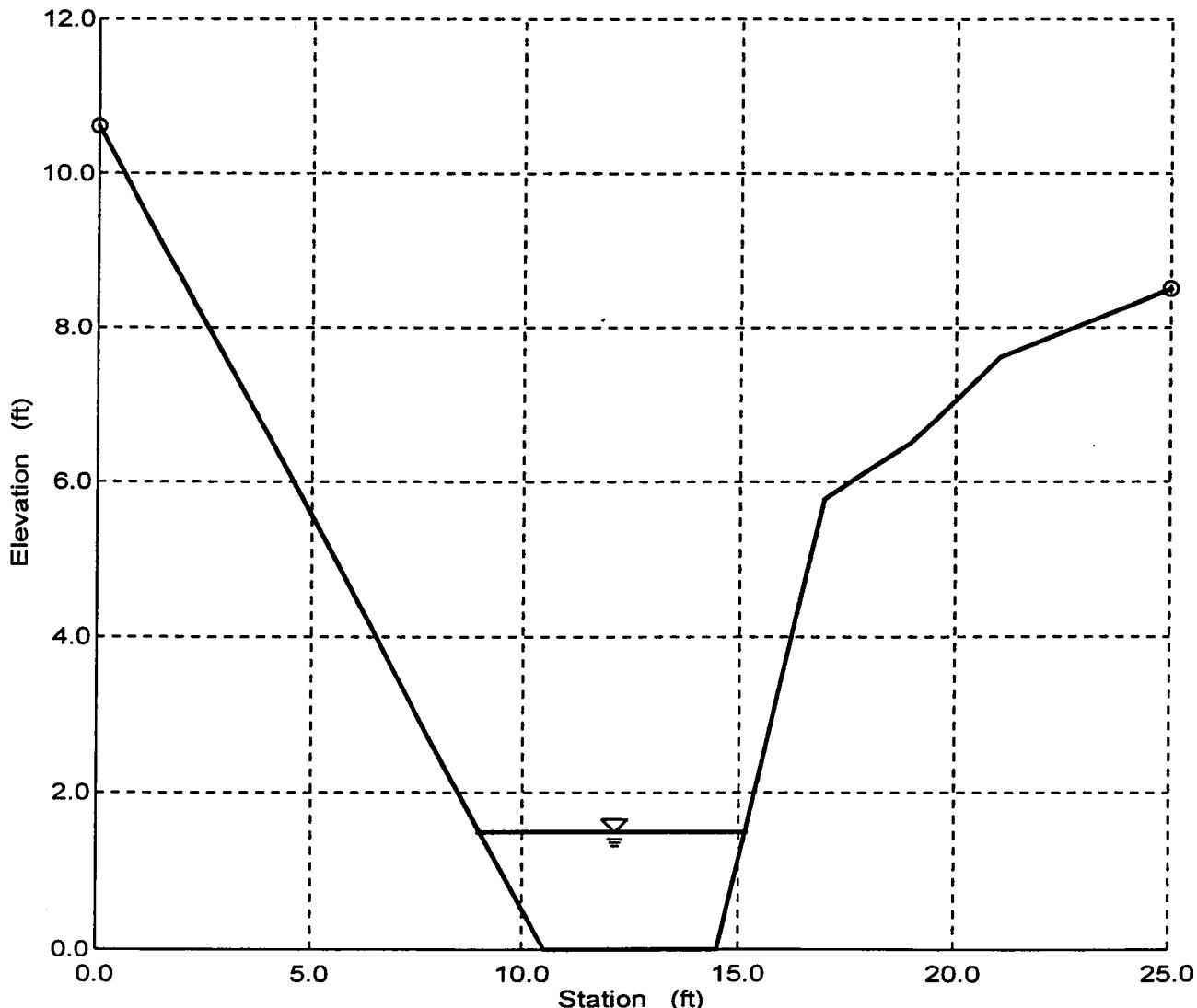
Cross Section for Irregular Channel

Project Description

Project File	c:\haestad\fmw\mercur.fm2
Worksheet	mercur cnyn
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data

Wtd. Mannings Coefficient	0.035
Channel Slope	0.070000 ft/ft
Water Surface Elevation	1.50 ft
Discharge	84.32 cfs



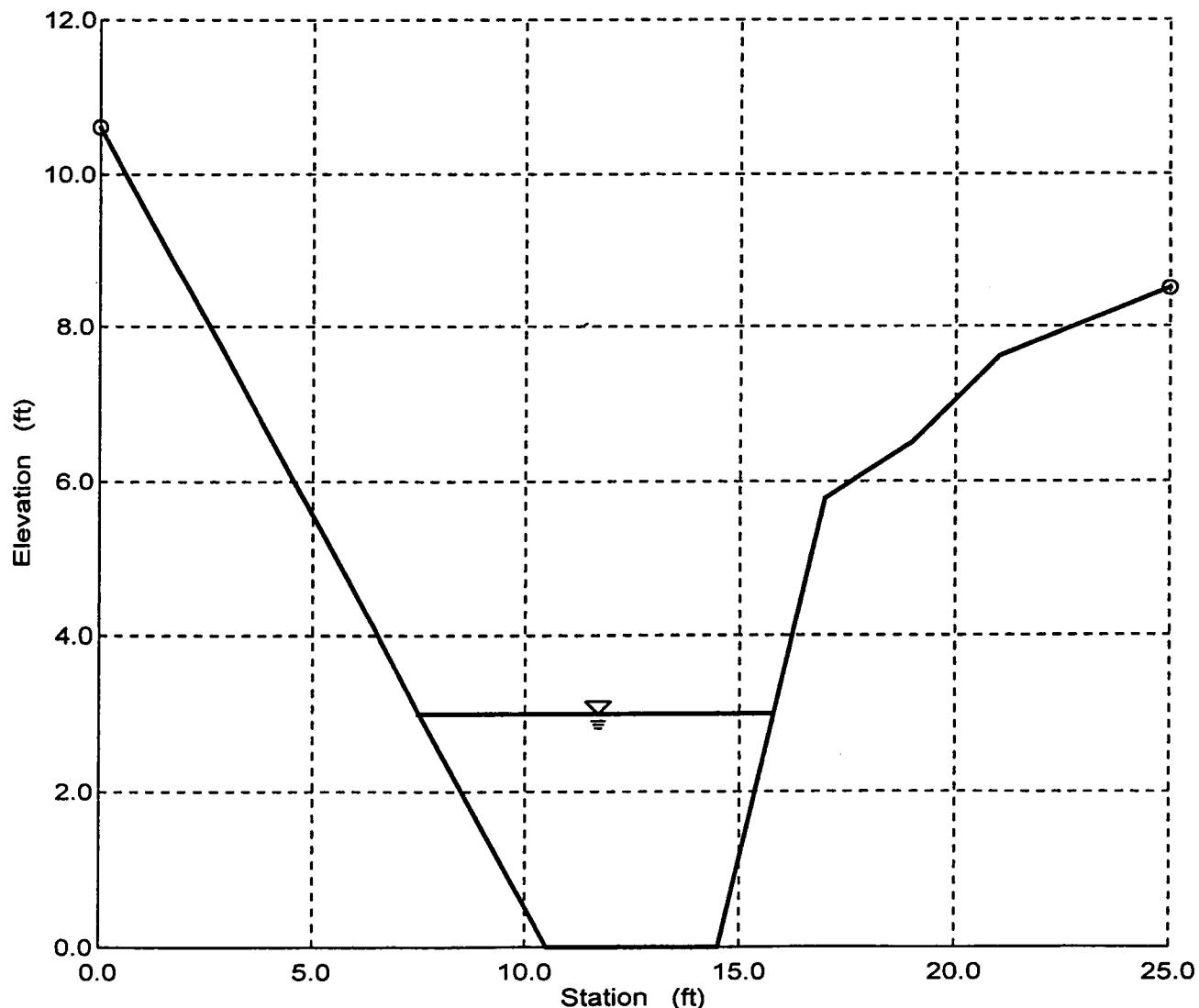
Cross Section
Cross Section for Irregular Channel

Project Description

Project File c:\haestad\fmw\mercur.fm2
Worksheet mercur cnyn
Flow Element Irregular Channel
Method Manning's Formula
Solve For Discharge

Section Data

Wtd. Mannings Coefficient 0.035
Channel Slope 0.070000 ft/ft
Water Surface Elevation 3.00 ft
Discharge 283.05 cfs



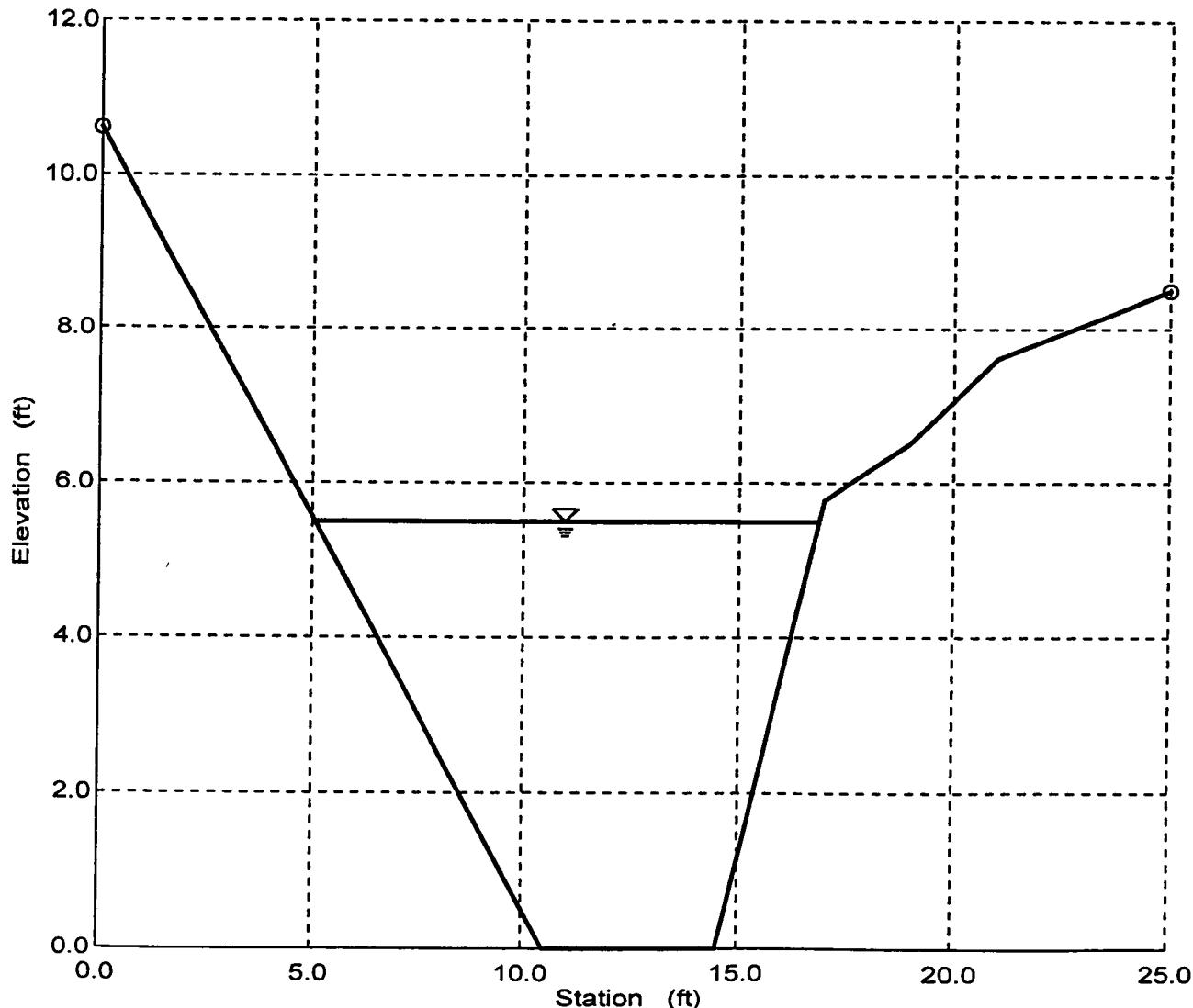
Cross Section Cross Section for Irregular Channel

Project Description

Project File c:\haestad\fmw\mercur.fm2
Worksheet mercur cnyn
Flow Element Irregular Channel
Method Manning's Formula
Solve For Discharge

Section Data

Wtd. Mannings Coefficient 0.035
Channel Slope 0.070000 ft/ft
Water Surface Elevation 5.50 ft
Discharge 889.86 cfs



Worksheet
Worksheet for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach a.fm2
Worksheet 10 year
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Input Data

Channel Slope 0.005000 ft/ft

Elevation range: 0.00 ft to 4.80 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	4.80	0.00	35.10	0.030
6.00	1.80			
21.00	1.50			
25.50	0.00			
35.10	4.80			

Discharge 49.00 cfs

Results

Wtd. Mannings Coefficient	0.030
Water Surface Elevation	2.12 ft
Flow Area	17.70 ft ²
Wetted Perimeter	25.18 ft
Top Width	24.36 ft
Height	2.12 ft
Critical Depth	1.88 ft
Critical Slope	0.017032 ft/ft
Velocity	2.77 ft/s
Velocity Head	0.12 ft
Specific Energy	2.23 ft
Froude Number	0.57

Flow is subcritical.

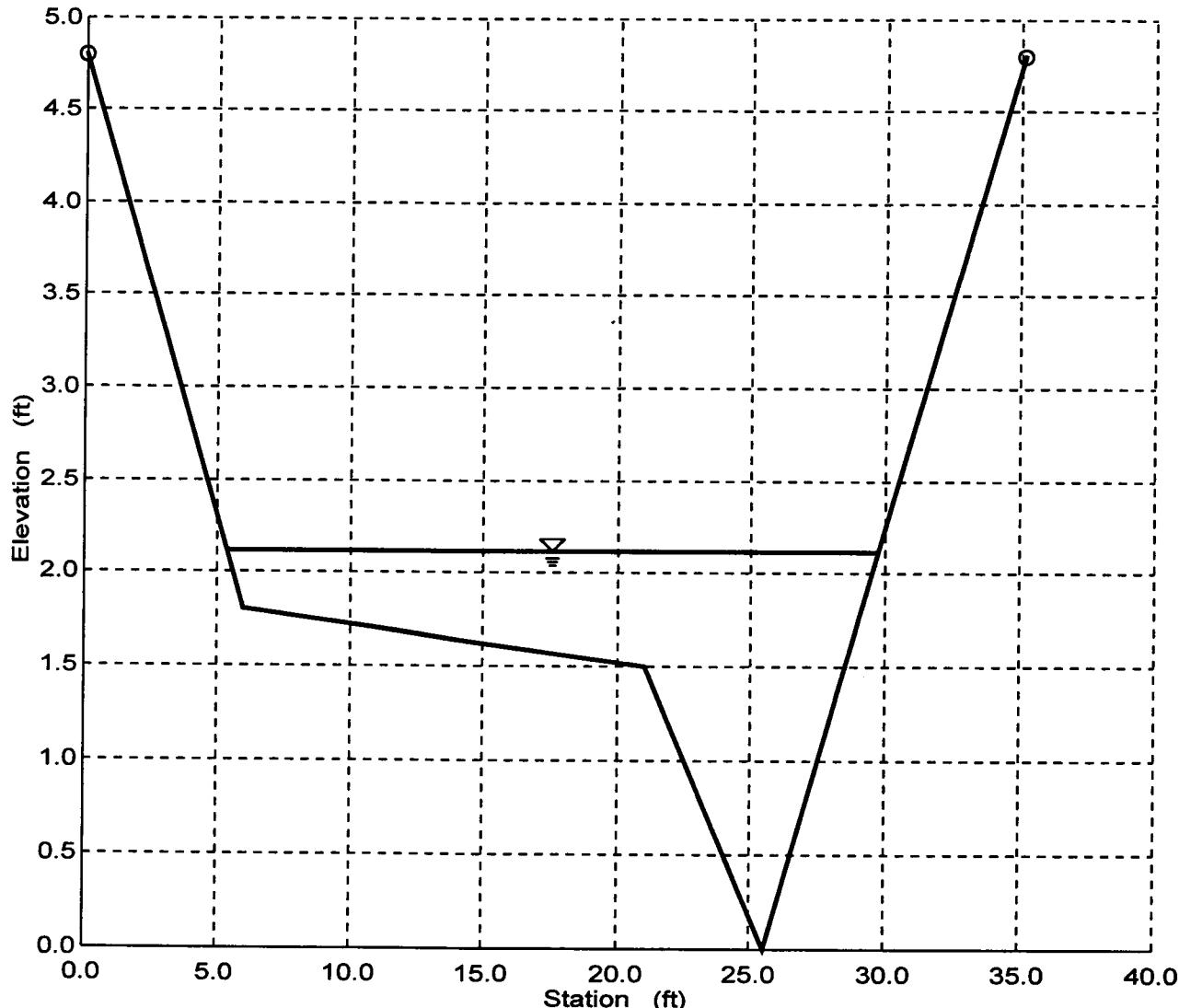
Cross Section Cross Section for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach a.fm2
Worksheet 10 year
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Section Data

Wtd. Mannings Coefficient 0.030
Channel Slope 0.005000 ft/ft
Water Surface Elevation 2.12 ft
Discharge 49.00 cfs



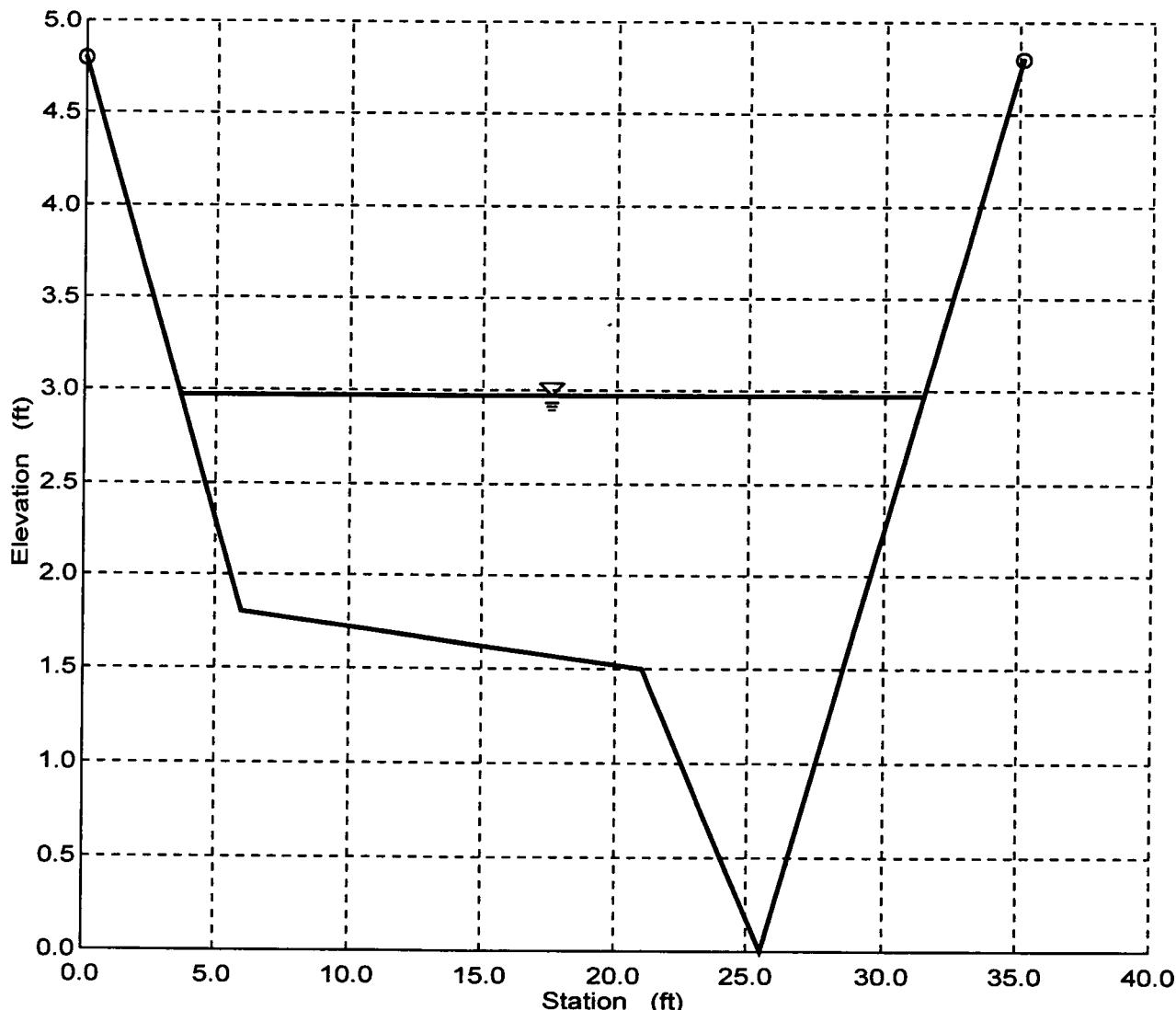
Cross Section Cross Section for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach a.fm2
Worksheet 100 year
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Section Data

Wtd. Mannings Coefficient 0.030
Channel Slope 0.005000 ft/ft
Water Surface Elevation 2.97 ft
Discharge 173.00 cfs



Worksheet
Worksheet for Trapezoidal Channel

Project Description

Project File	c:\haestad\fmw\reach b.fm2
Worksheet	10 year
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Mannings Coefficient	0.030
Channel Slope	0.010000 ft/ft
Left Side Slope	3.000000 H : V
Right Side Slope	3.000000 H : V
Bottom Width	12.00 ft
Discharge	69.00 cfs

Results

Depth	1.03	ft
Flow Area	15.62	ft ²
Wetted Perimeter	18.54	ft
Top Width	18.20	ft
Critical Depth	0.93	ft
Critical Slope	0.014559	ft/ft
Velocity	4.42	ft/s
Velocity Head	0.30	ft
Specific Energy	1.34	ft
Froude Number	0.84	
Flow is subcritical.		

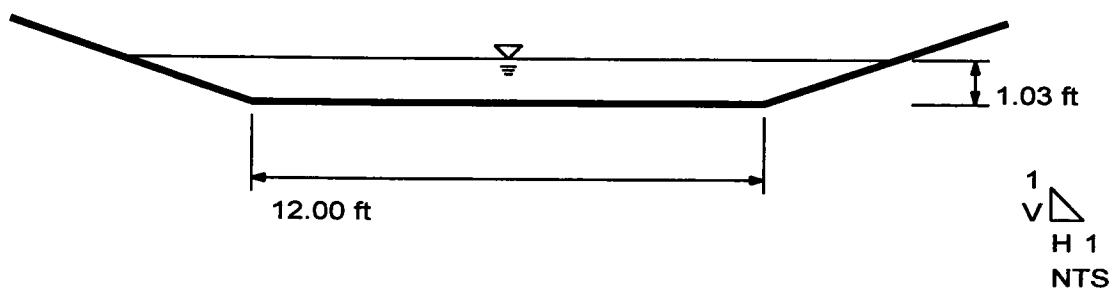
Cross Section
Cross Section for Trapezoidal Channel

Project Description

Project File c:\haestad\fmw\reach b.fm2
Worksheet 10 year
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Channel Depth

Section Data

Mannings Coefficient 0.030
Channel Slope 0.010000 ft/ft
Depth 1.03 ft
Left Side Slope 3.000000 H : V
Right Side Slope 3.000000 H : V
Bottom Width 12.00 ft
Discharge 69.00 cfs



Cross Section

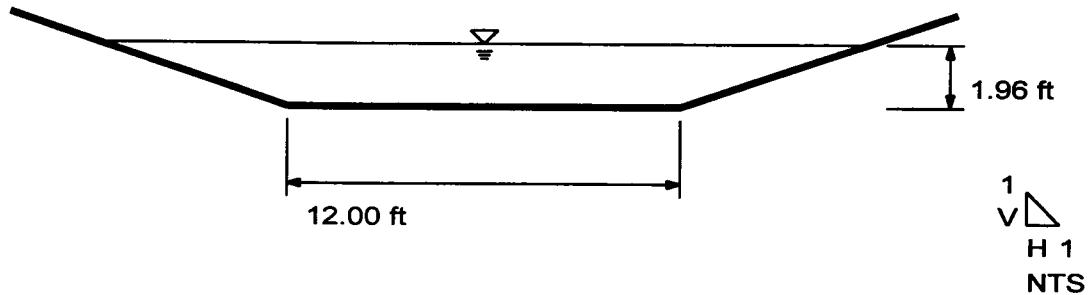
Cross Section for Trapezoidal Channel

Project Description

Project File c:\haestad\fmw\reach b.fm2
Worksheet 100 year
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Channel Depth

Section Data

Mannings Coefficient 0.030
Channel Slope 0.010000 ft/ft
Depth 1.96 ft
Left Side Slope 3.000000 H : V
Right Side Slope 3.000000 H : V
Bottom Width 12.00 ft
Discharge 221.00 cfs



Worksheet
Worksheet for Irregular Channel

Project Description

Project File	c:\haestad\fmw\reach c.fm2
Worksheet	10year
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope	0.005000 ft/ft
---------------	----------------

Elevation range: 0.00 ft to 5.50 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	5.50	0.00	74.00	0.035
25.00	4.50			
31.00	2.50			
36.00	2.50			
36.00	0.00			
38.00	0.00			
38.00	2.50			
43.00	2.50			
49.00	4.50			
74.00	5.50			
Discharge	109.00	cfs		

Results

Wtd. Mannings Coefficient	0.035
Water Surface Elevation	4.12 ft
Flow Area	32.38 ft ²
Wetted Perimeter	27.26 ft
Top Width	21.74 ft
Height	4.12 ft
Critical Depth	3.42 ft
Critical Slope	0.024873 ft/ft
Velocity	3.37 ft/s
Velocity Head	0.18 ft
Specific Energy	4.30 ft
Froude Number	0.49

Flow is subcritical.

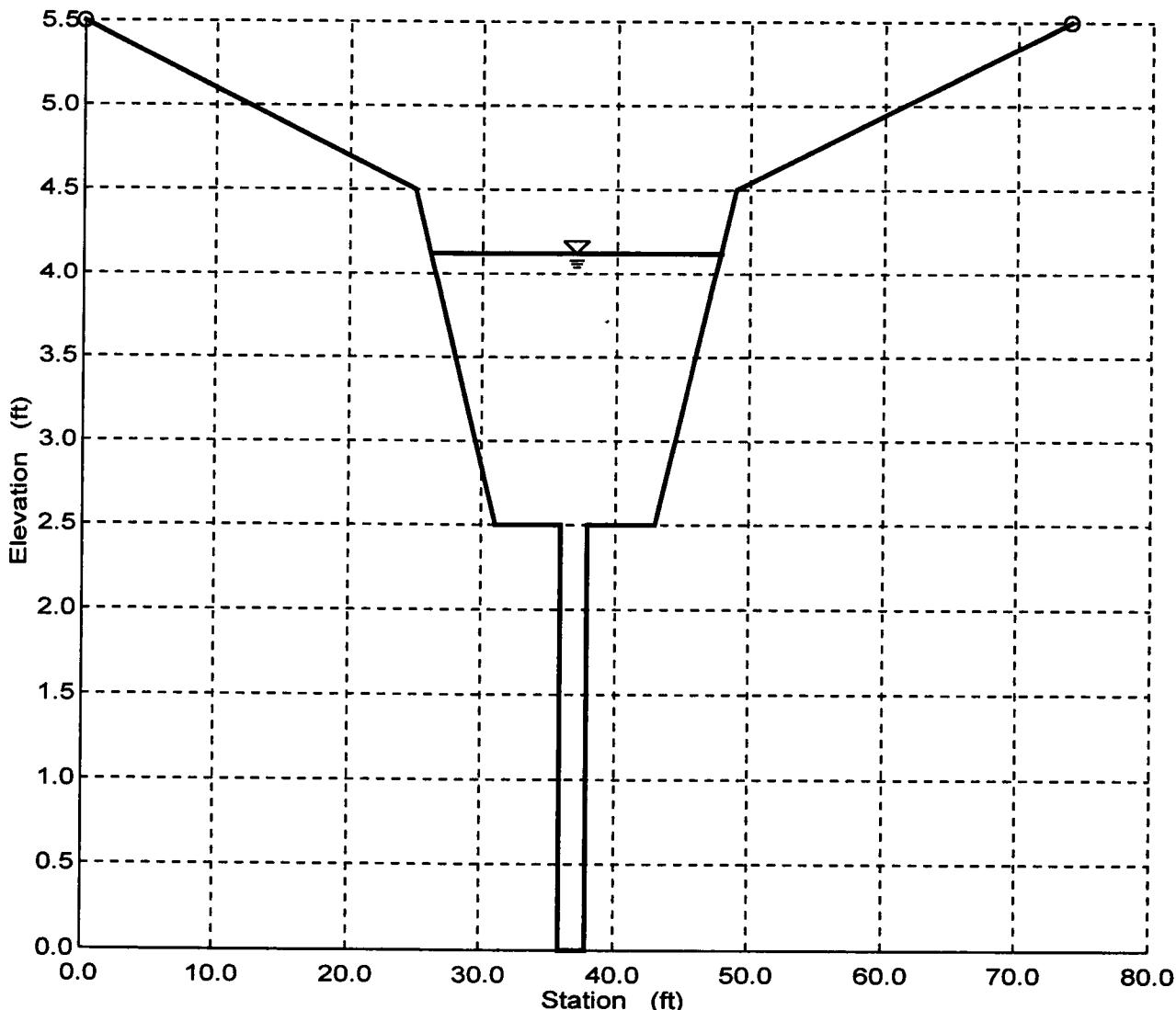
Cross Section Cross Section for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach c.fm2
Worksheet 10year
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Section Data

Wtd. Mannings Coefficient 0.035
Channel Slope 0.005000 ft/ft
Water Surface Elevation 4.12 ft
Discharge 109.00 cfs



Worksheet
Worksheet for Irregular Channel

Project Description

Project File	c:\haestad\fmw\reach.c.fm2
Worksheet	100 year
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope	0.005000 ft/ft
---------------	----------------

Elevation range: 0.00 ft to 6.50 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	6.50	0.00	124.00	0.035
50.00	4.50			
56.00	2.50			
61.00	2.50			
61.00	0.00			
63.00	0.00			
63.00	2.50			
68.00	2.50			
74.00	4.50			
124.00	6.50			
Discharge	492.00	cfs		

Results

Wtd. Mannings Coefficient	0.035
Water Surface Elevation	6.05 ft
Flow Area	138.32 ft ²
Wetted Perimeter	107.24 ft
Top Width	101.53 ft
Height	6.05 ft
Critical Depth	5.35 ft
Critical Slope	0.018769 ft/ft
Velocity	3.56 ft/s
Velocity Head	0.20 ft
Specific Energy	6.25 ft
Froude Number	0.54

Flow is subcritical.

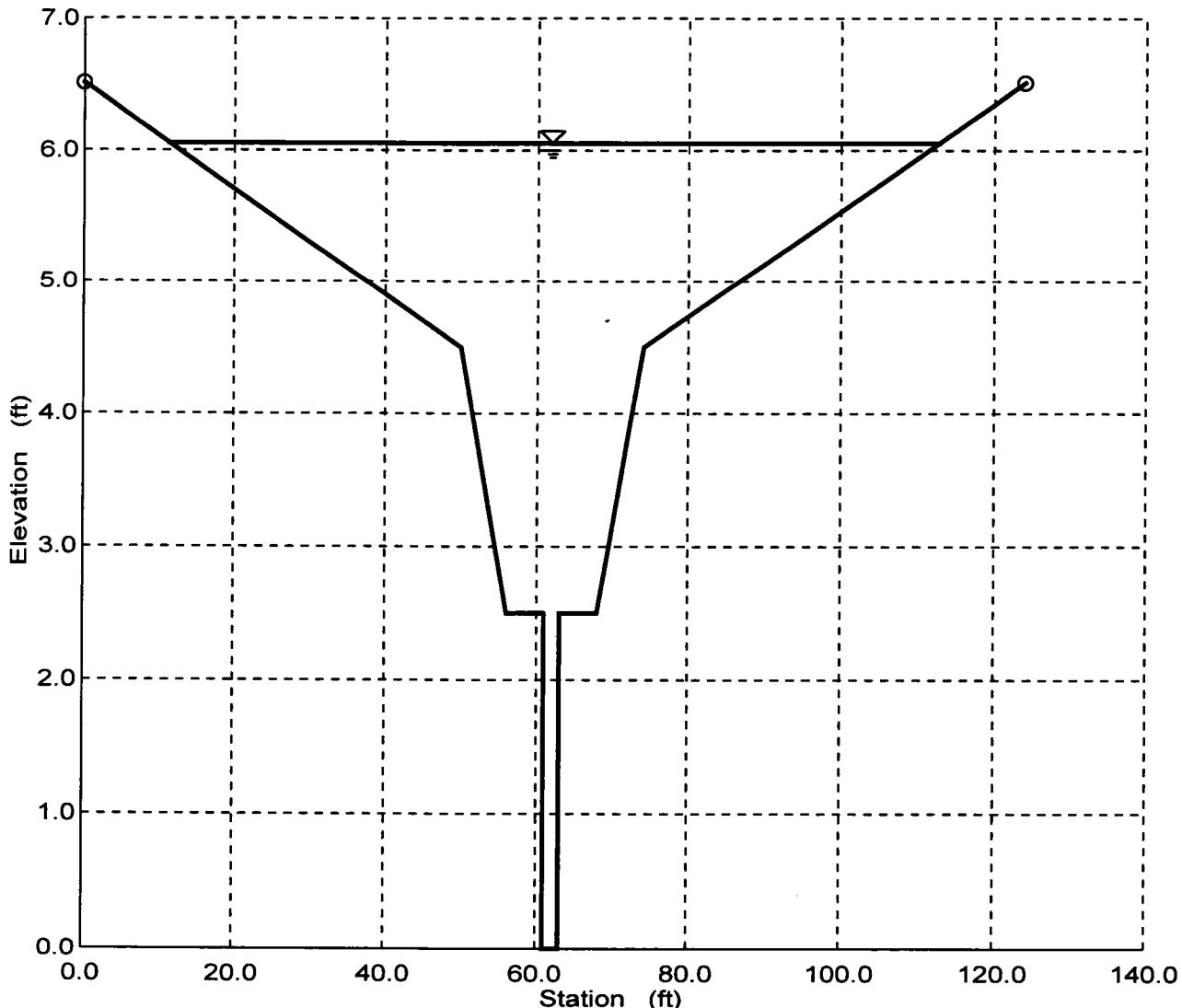
Cross Section Cross Section for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach.c.fm2
Worksheet 100 year
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Section Data

Wtd. Mannings Coefficient 0.035
Channel Slope 0.005000 ft/ft
Water Surface Elevation 6.05 ft
Discharge 492.00 cfs



Worksheet
Worksheet for Irregular Channel

Project Description

Project File	c:\haestad\fmw\reach c.fm2
Worksheet	Reach C1_10
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope	0.020000 ft/ft
---------------	----------------

Elevation range: 0.00 ft to 6.17 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	6.17	0.00	54.00	0.035
5.00	4.50			
15.00	4.50			
21.00	2.50			
26.00	2.50			
26.00	0.00			
28.00	0.00			
28.00	2.50			
33.00	2.50			
39.00	4.50			
49.00	4.50			
54.00	6.17			
Discharge	49.00	cfs		

Results

Wtd. Mannings Coefficient	0.035
Water Surface Elevation	3.00 ft
Flow Area	11.71 ft ²
Wetted Perimeter	20.15 ft
Top Width	14.99 ft
Height	3.00 ft
Critical Depth	2.90 ft
Critical Slope	0.030023 ft/ft
Velocity	4.18 ft/s
Velocity Head	0.27 ft
Specific Energy	3.27 ft
Froude Number	0.83
Flow is subcritical.	

Cross Section

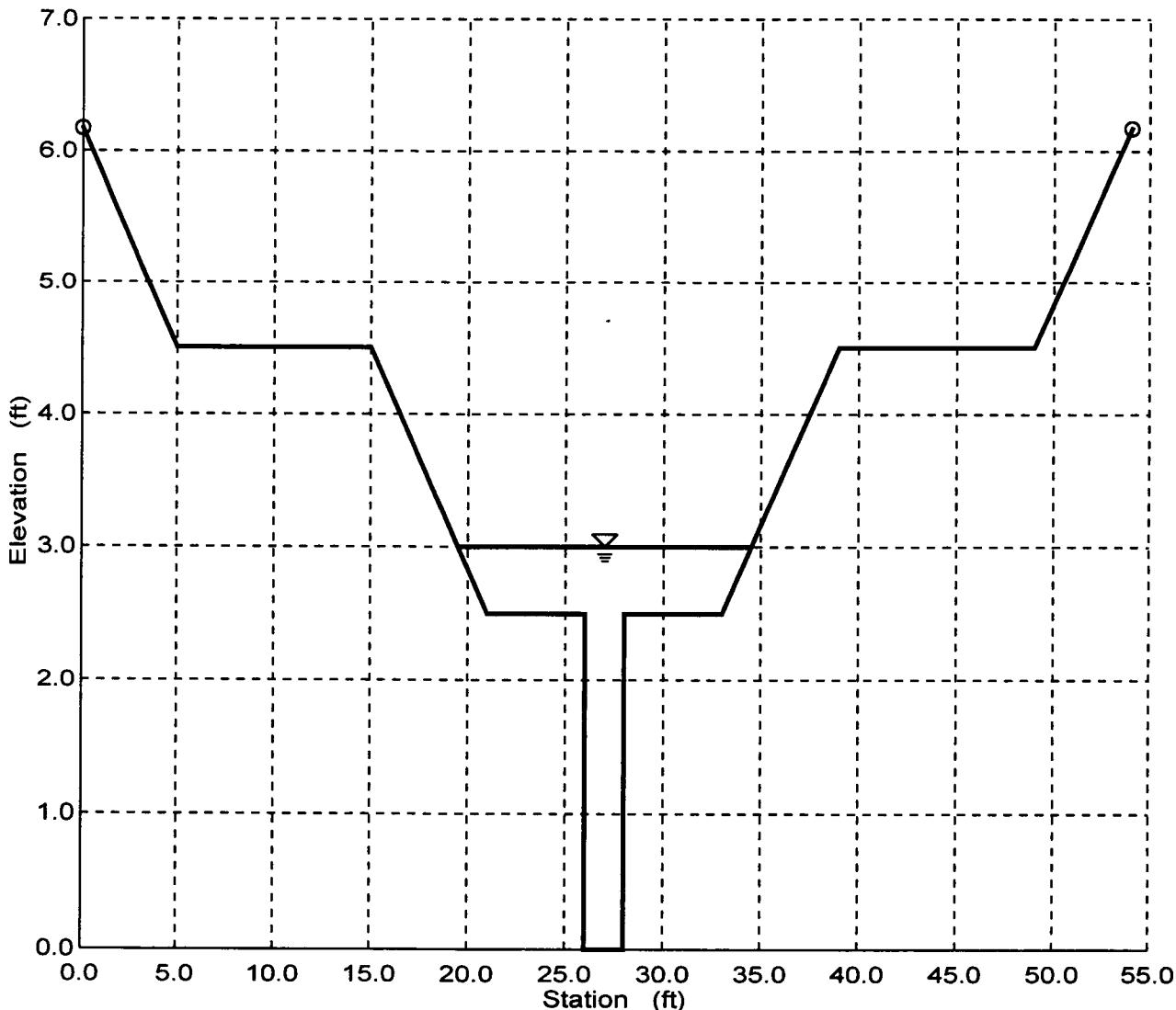
Cross Section for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach c.fm2
Worksheet Reach C1_10
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Section Data

Wtd. Mannings Coefficient 0.035
Channel Slope 0.020000 ft/ft
Water Surface Elevation 3.00 ft
Discharge 49.00 cfs



Worksheet
Worksheet for Irregular Channel

Project Description

Project File	c:\haestad\fmw\reach c.fm2
Worksheet	Reach C1_100
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope 0.020000 ft/ft

Elevation range: 0.00 ft to 6.00 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	6.00	0.00	54.00	0.035
15.00	4.50			
21.00	2.50			
26.00	2.50			
26.00	0.00			
28.00	0.00			
28.00	2.50			
33.00	2.50			
39.00	4.50			
54.00	6.00			

Discharge	256.00	cfs
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Results

Wtd. Mannings Coefficient	0.035
Water Surface Elevation	4.30 ft
Flow Area	36.22 ft ²
Wetted Perimeter	28.36 ft
Top Width	22.77 ft
Height	4.30 ft
Critical Depth	4.28 ft
Critical Slope	0.020538 ft/ft
Velocity	7.07 ft/s
Velocity Head	0.78 ft
Specific Energy	5.07 ft
Froude Number	0.99

Flow is subcritical.

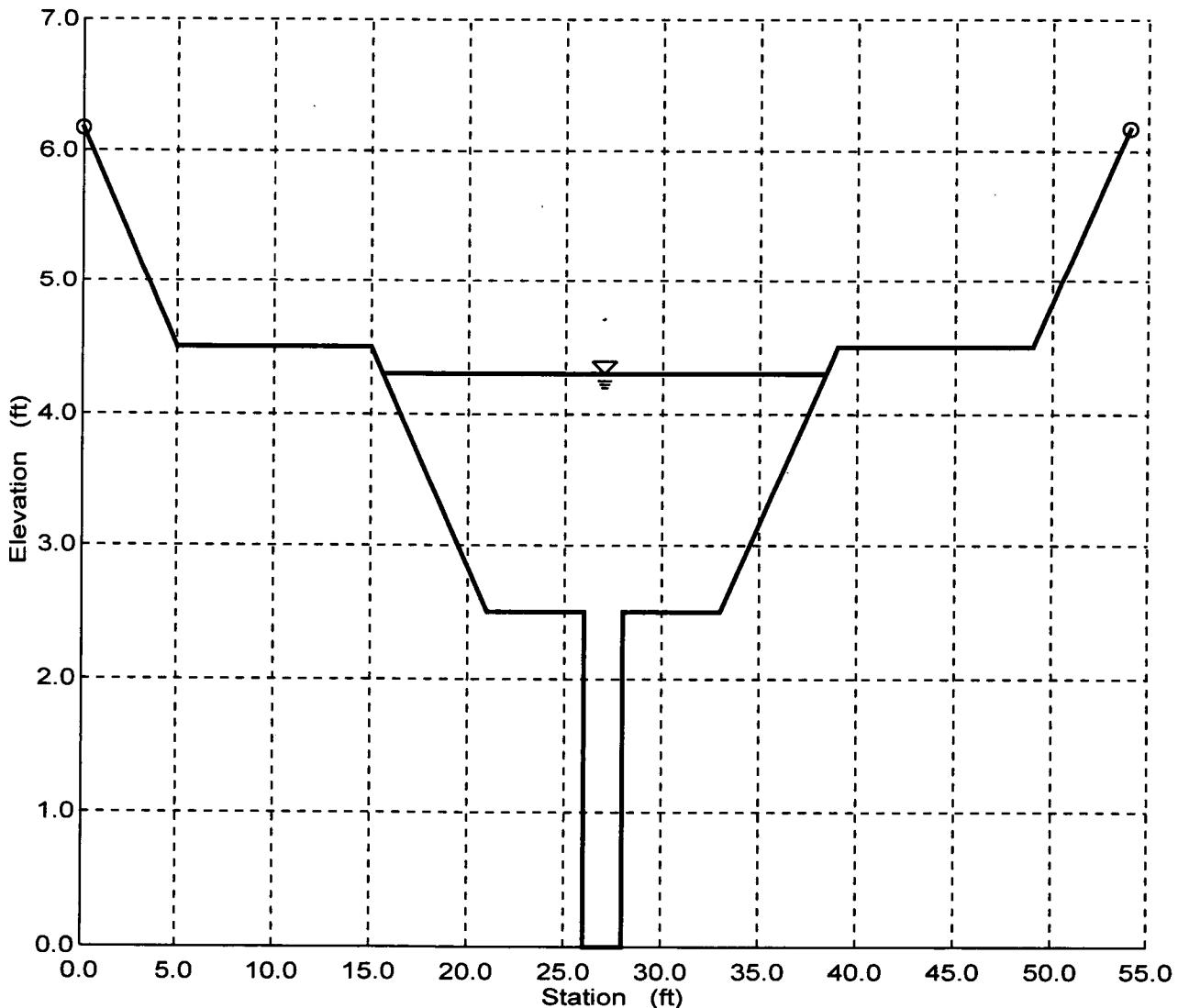
Cross Section Cross Section for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach c.fm2
Worksheet Reach C1_100
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Section Data

Wtd. Mannings Coefficient 0.035
Channel Slope 0.020000 ft/ft
Water Surface Elevation 4.30 ft
Discharge 256.00 cfs



Worksheet
Worksheet for Irregular Channel

Project Description

Project File	c:\haestad\fmw\reach d.fm2
Worksheet	10 year
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope	0.005000 ft/ft
---------------	----------------

Elevation range: 0.00 ft to 8.00 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	8.00	0.00	60.04	0.035
16.00	0.00			
31.00	5.00			
55.00	5.48			
60.04	8.00			

Discharge	131.00	cfs
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Results

Wtd. Mannings Coefficient	0.035
Water Surface Elevation	3.54 ft
Flow Area	31.37 ft ²
Wetted Perimeter	19.12 ft
Top Width	17.71 ft
Height	3.54 ft
Critical Depth	2.80 ft
Critical Slope	0.017684 ft/ft
Velocity	4.18 ft/s
Velocity Head	0.27 ft
Specific Energy	3.81 ft
Froude Number	0.55

Flow is subcritical.

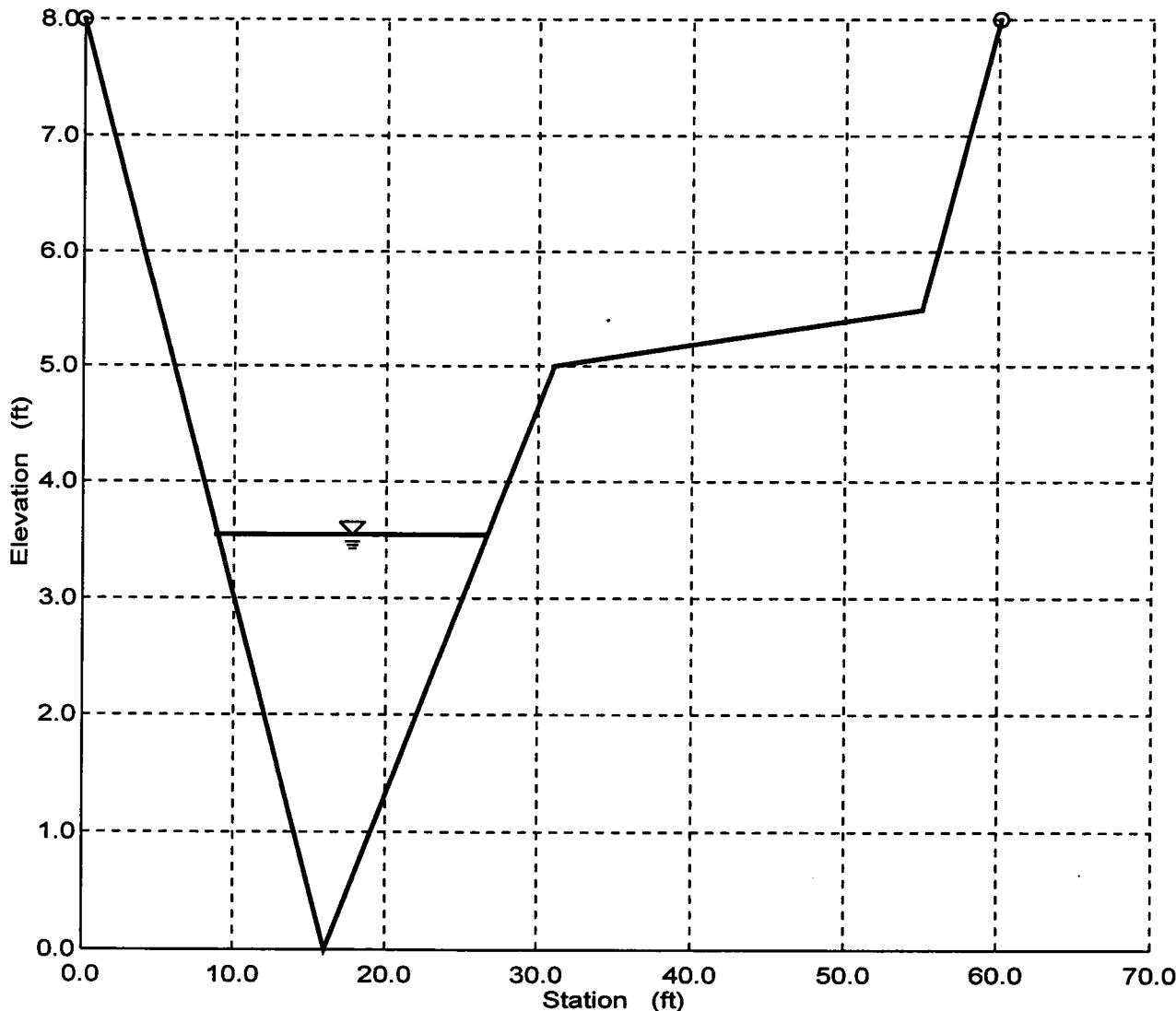
Cross Section Cross Section for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach d.fm2
Worksheet 10 year
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Section Data

Wtd. Mannings Coefficient 0.035
Channel Slope 0.005000 ft/ft
Water Surface Elevation 3.54 ft
Discharge 131.00 cfs



Worksheet

Worksheet for Irregular Channel

Project Description

Project File	c:\haestad\fmw\reach d.fm2
Worksheet	100 year
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope	0.005000 ft/ft
---------------	----------------

Elevation range: 0.00 ft to 8.00 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	8.00	0.00	60.04	0.035
16.00	0.00			
31.00	5.00			
55.00	5.48			
60.04	8.00			

Discharge	629.00	cfs
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Results

Wtd. Mannings Coefficient	0.035
Water Surface Elevation	6.31 ft
Flow Area	123.41 ft ²
Wetted Perimeter	55.79 ft
Top Width	53.29 ft
Height	6.31 ft
Critical Depth	5.57 ft
Critical Slope	0.015838 ft/ft
Velocity	5.10 ft/s
Velocity Head	0.40 ft
Specific Energy	6.72 ft
Froude Number	0.59

Flow is subcritical.

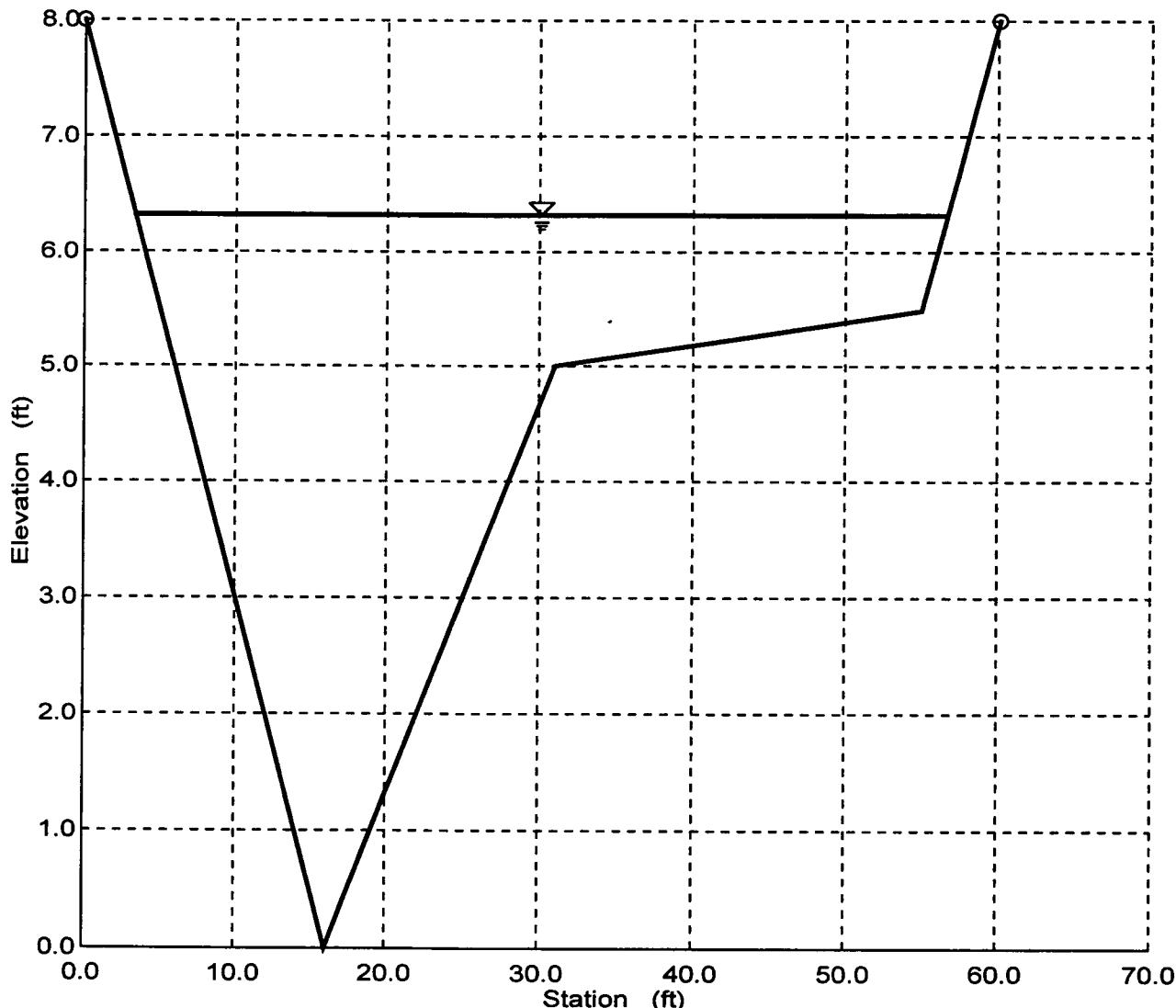
Cross Section Cross Section for Irregular Channel

Project Description

Project File	c:\haestad\fmw\reach d.fm2
Worksheet	100 year
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data

Wtd. Mannings Coefficient	0.035
Channel Slope	0.005000 ft/ft
Water Surface Elevation	6.31 ft
Discharge	629.00 cfs



Worksheet
Worksheet for Irregular Channel

Project Description

Project File	c:\haestad\fmw\reach e.fm2
Worksheet	10 year
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope	0.075000 ft/ft
---------------	----------------

Elevation range: 0.00 ft to 8.00 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	8.00	0.00	60.04	0.055
16.00	0.00			
31.00	5.00			
55.00	5.48			
60.04	8.00			

Discharge	131.00	cfs
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Results

Wtd. Mannings Coefficient	0.055
Water Surface Elevation	2.53 ft
Flow Area	15.95 ft ²
Wetted Perimeter	13.63 ft
Top Width	12.63 ft
Height	2.53 ft
Critical Depth	2.80 ft
Critical Slope	0.043667 ft/ft
Velocity	8.21 ft/s
Velocity Head	1.05 ft
Specific Energy	3.57 ft
Froude Number	1.29

Flow is supercritical.

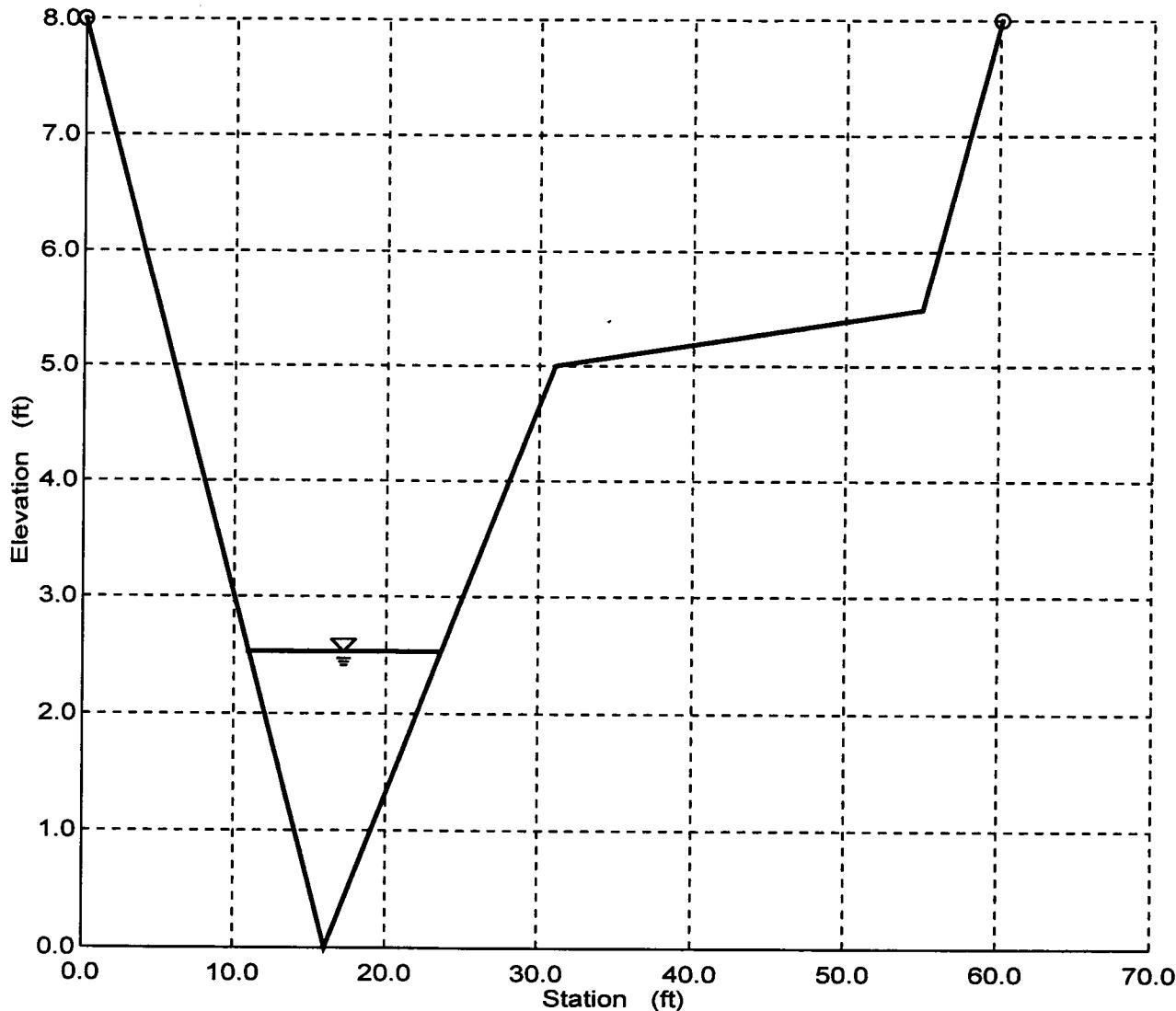
Cross Section Cross Section for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach e.fm2
Worksheet 10 year
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Section Data

Wtd. Mannings Coefficient 0.055
Channel Slope 0.075000 ft/ft
Water Surface Elevation 2.53 ft
Discharge 131.00 cfs



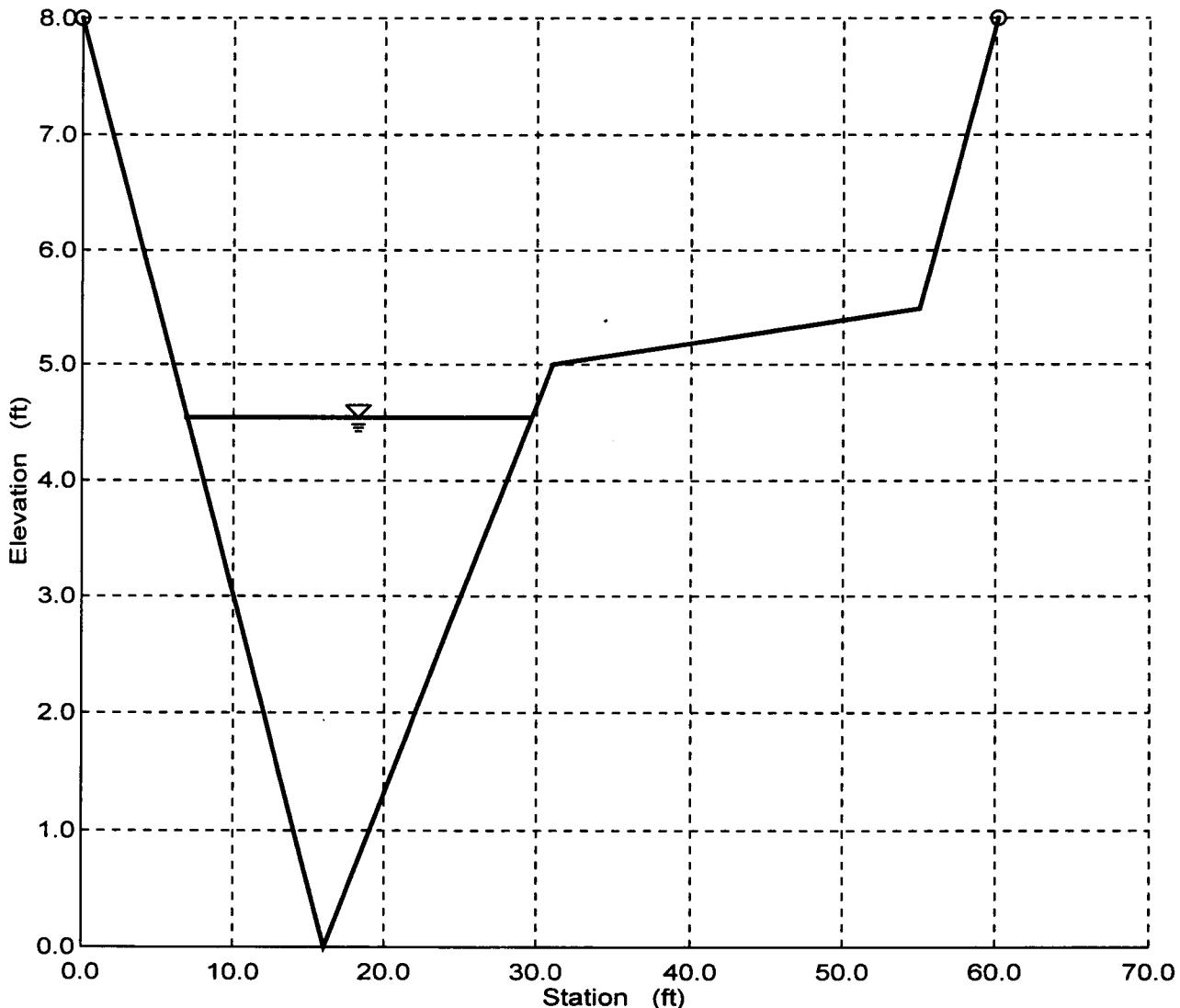
Cross Section Cross Section for Irregular Channel

Project Description

Project File	c:\haestad\fmw\reach e.fm2
Worksheet	100 year
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data

Wtd. Mannings Coefficient	0.055
Channel Slope	0.075000 ft/ft
Water Surface Elevation	4.53 ft
Discharge	623.00 cfs



Worksheet

Worksheet for Trapezoidal Channel

Project Description

Project File c:\haestad\fmw\reach f.fm2
Worksheet 10 year
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Channel Depth

Input Data

Mannings Coefficient 0.058
Channel Slope 0.050000 ft/ft
Left Side Slope 3.000000 H : V
Right Side Slope 3.000000 H : V
Bottom Width 12.00 ft
Discharge 131.00 cfs

Results

Depth 1.36 ft
Flow Area 21.81 ft²
Wetted Perimeter 20.58 ft
Top Width 20.14 ft
Critical Depth 1.37 ft
Critical Slope 0.048156 ft/ft
Velocity 6.01 ft/s
Velocity Head 0.56 ft
Specific Energy 1.92 ft
Froude Number 1.02
Flow is supercritical.

Cross Section

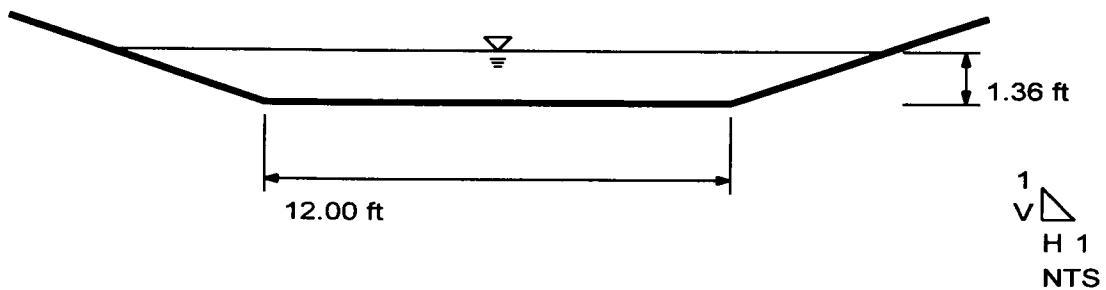
Cross Section for Trapezoidal Channel

Project Description

Project File c:\haestad\fmw\reach f.fm2
Worksheet 10 year
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Channel Depth

Section Data

Mannings Coefficient 0.058
Channel Slope 0.050000 ft/ft
Depth 1.36 ft
Left Side Slope 3.000000 H : V
Right Side Slope 3.000000 H : V
Bottom Width 12.00 ft
Discharge 131.00 cfs



Worksheet Worksheet for Trapezoidal Channel

Project Description

Project File	c:\haestad\fmw\reach f.fm2
Worksheet	100 year
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Mannings Coefficient	0.058
Channel Slope	0.050000 ft/ft
Left Side Slope	3.000000 H : V
Right Side Slope	3.000000 H : V
Bottom Width	12.00 ft
Discharge	623.00 cfs

Results

Depth	3.11	ft
Flow Area	66.40	ft ²
Wetted Perimeter	31.68	ft
Top Width	30.67	ft
Critical Depth	3.31	ft
Critical Slope	0.038924	ft/ft
Velocity	9.38	ft/s
Velocity Head	1.37	ft
Specific Energy	4.48	ft
Froude Number	1.12	

Flow is supercritical.

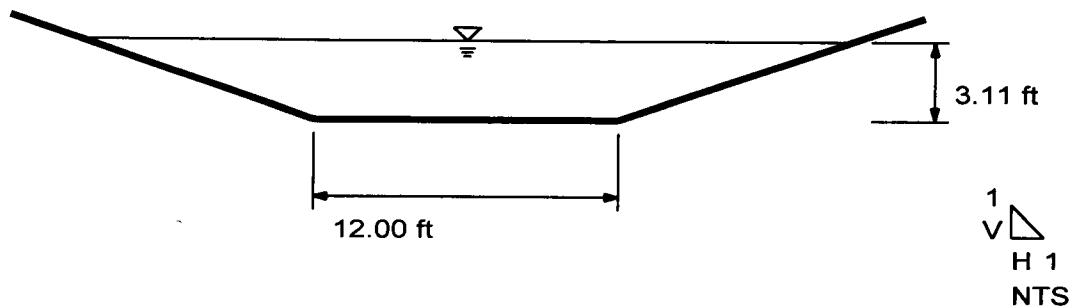
Cross Section
Cross Section for Trapezoidal Channel

Project Description

Project File c:\haestad\fmw\reach f.fm2
Worksheet 100 year
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Channel Depth

Section Data

Mannings Coefficient 0.058
Channel Slope 0.050000 ft/ft
Depth 3.11 ft
Left Side Slope 3.000000 H : V
Right Side Slope 3.000000 H : V
Bottom Width 12.00 ft
Discharge 623.00 cfs



DROP STRUCTURE DESIGN TEMPLATE
Barrick Resources (USA) Inc., Mercur Mine
Northern Diversion, Reach F

INPUT DATA:

TOTAL DISCHARGE - Q (CFS)	131 CFS	UNIT DISCHARG	4.85 CFS/FT
WIDTH OF WEIR - W (FT)	27 FT		
DROP HEIGHT - DELTA Z (FT)	2.5 FT	Plunge Pool Status:	
D90 PARTICLE SIZE (mm)	78 mm	Jump Controlled	

RESULTS:

CRITICAL DEPTH Yc (FT)	0.90 FT
JET THICKNESS Y1 (FT)	0.37 FT
POOL DEPTH UNDER NAPPE (F	1.27 FT
JUMP HT (FT)	1.82 FT
COUNTER WEIR HT (FT)	0.30 FT
DROP LENGTH (FT)	9.81 FT
JUMP LENGTH (FT)	9.99 FT
SCOUR DEPTH (FT)	1.07 FT
VELOCITY AT WEIR (FT/S)	5.39 FT/S
VELOCITY IN POOL (FT/S)	2.67 FT/S
TOTAL DIST BTWN DROPS (FT)	19.80 FT

Worksheet

Worksheet for Trapezoidal Channel

Project Description

Project File c:\haestad\fmw\reach g.fm2
Worksheet 10 year
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Channel Depth

Input Data

Mannings Coefficient 0.100
Channel Slope 0.125000 ft/ft
Left Side Slope 2.000000 H : V
Right Side Slope 2.000000 H : V
Bottom Width 10.00 ft
Discharge 139.14 cfs

Results

Depth 1.68 ft
Flow Area 22.45 ft²
Wetted Perimeter 17.51 ft
Top Width 16.72 ft
Critical Depth 1.62 ft
Critical Slope 0.141733 ft/ft
Velocity 6.20 ft/s
Velocity Head 0.60 ft
Specific Energy 2.28 ft
Froude Number 0.94
Flow is subcritical.

Cross Section

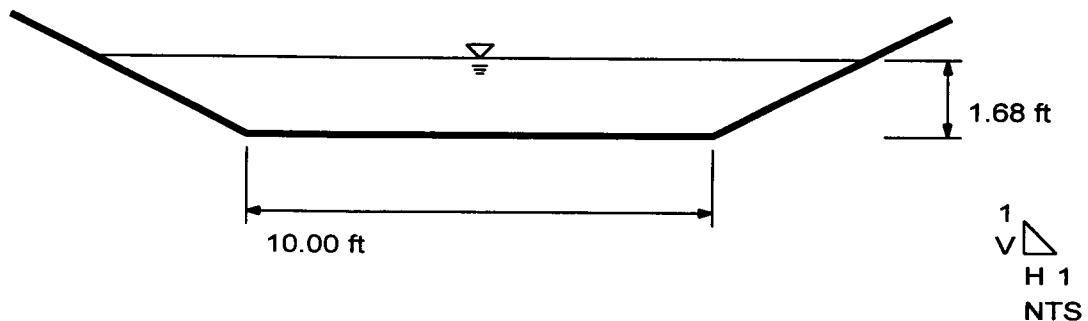
Cross Section for Trapezoidal Channel

Project Description

Project File c:\haestad\fmw\reach g.fm2
Worksheet 10 year
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Channel Depth

Section Data

Mannings Coefficient 0.100
Channel Slope 0.125000 ft/ft
Depth 1.68 ft
Left Side Slope 2.000000 H : V
Right Side Slope 2.000000 H : V
Bottom Width 10.00 ft
Discharge 139.14 cfs



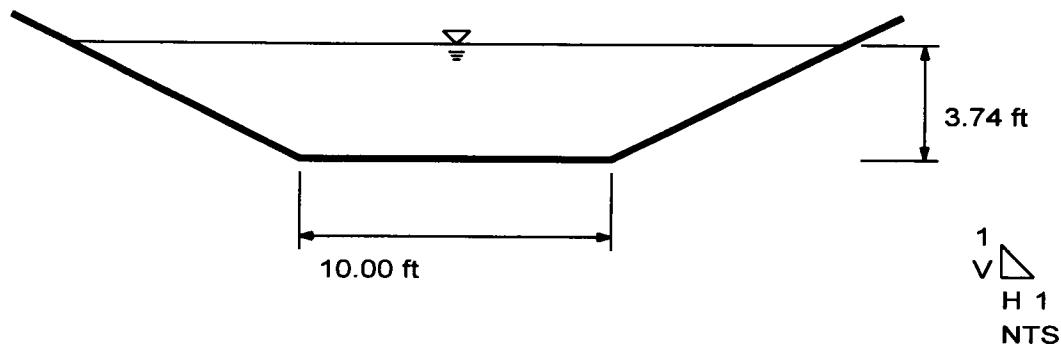
Cross Section
Cross Section for Trapezoidal Channel

Project Description

Project File c:\haestad\fmw\reach g.fm2
Worksheet 100 year
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Channel Depth

Section Data

Mannings Coefficient 0.100
Channel Slope 0.125000 ft/ft
Depth 3.74 ft
Left Side Slope 2.000000 H : V
Right Side Slope 2.000000 H : V
Bottom Width 10.00 ft
Discharge 623.00 cfs



DROP STRUCTURE DESIGN TEMPLATE
Barrick Resources (USA) Inc., Mercur Mine
Northern Diversion, Reach G

INPUT DATA:

TOTAL DISCHARGE - Q (CFS)	139 CFS	UNIT DISCHAR	5.79 CFS
WIDTH OF WEIR - W (FT)	24 FT		
DROP HEIGHT - DELTA Z (FT)	3.5 FT	Plunge Pool Status:	
D90 PARTICLE SIZE (mm)	100 mm	Jump Controlled	

RESULTS:

CRITICAL DEPTH Yc (FT)	1.01 FT
JET THICKNESS Y1 (FT)	0.39 FT
POOL DEPTH UNDER NAPPE (FT)	1.54 FT
JUMP HT (FT)	2.13 FT
COUNTER WEIR HT (FT)	0.35 FT
DROP LENGTH (FT)	13.46 FT
JUMP LENGTH (FT)	12.01 FT
SCOUR DEPTH (FT)	1.19 FT
VELOCITY AT WEIR (FT/S)	5.71 FT/S
VELOCITY IN POOL (FT/S)	2.72 FT/S
TOTAL DIST BTWN DROPS (FT)	25.47 FT

Worksheet
Worksheet for Triangular Channel

Project Description

Project File c:\haestad\fmw\reach h.fm2
Worksheet 10 year
Flow Element Triangular Channel
Method Manning's Formula
Solve For Channel Depth

Input Data

Mannings Coefficient 0.040
Channel Slope 0.050000 ft/ft
Left Side Slope 3.000000 H : V
Right Side Slope 1.500000 H : V
Discharge 26.00 cfs

Results

Depth 1.38 ft
Flow Area 4.28 ft²
Wetted Perimeter 6.85 ft
Top Width 6.21 ft
Critical Depth 1.53 ft
Critical Slope 0.029084 ft/ft
Velocity 6.07 ft/s
Velocity Head 0.57 ft
Specific Energy 1.95 ft
Froude Number 1.29
Flow is supercritical.

Cross Section

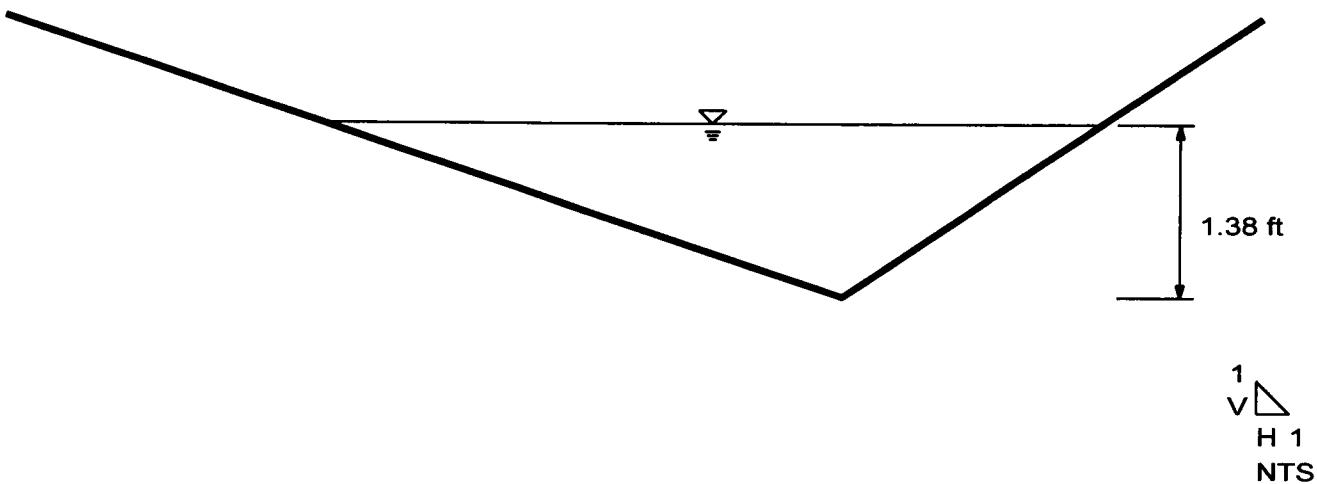
Cross Section for Triangular Channel

Project Description

Project File	c:\haestad\fmw\reach h.fm2
Worksheet	10 year
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficient	0.040
Channel Slope	0.050000 ft/ft
Depth	1.38 ft
Left Side Slope	3.000000 H : V
Right Side Slope	1.500000 H : V
Discharge	26.00 cfs



Worksheet

Worksheet for Triangular Channel

Project Description

Project File	c:\haestad\fmw\reach h.fm2
Worksheet	100 year
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Mannings Coefficient	0.040
Channel Slope	0.050000 ft/ft
Left Side Slope	3.000000 H : V
Right Side Slope	1.500000 H : V
Discharge	119.00 cfs

Results

Depth	2.44	ft
Flow Area	13.40	ft ²
Wetted Perimeter	12.12	ft
Top Width	10.98	ft
Critical Depth	2.81	ft
Critical Slope	0.023745	ft/ft
Velocity	8.88	ft/s
Velocity Head	1.23	ft
Specific Energy	3.67	ft
Froude Number	1.42	

Flow is supercritical.

Cross Section

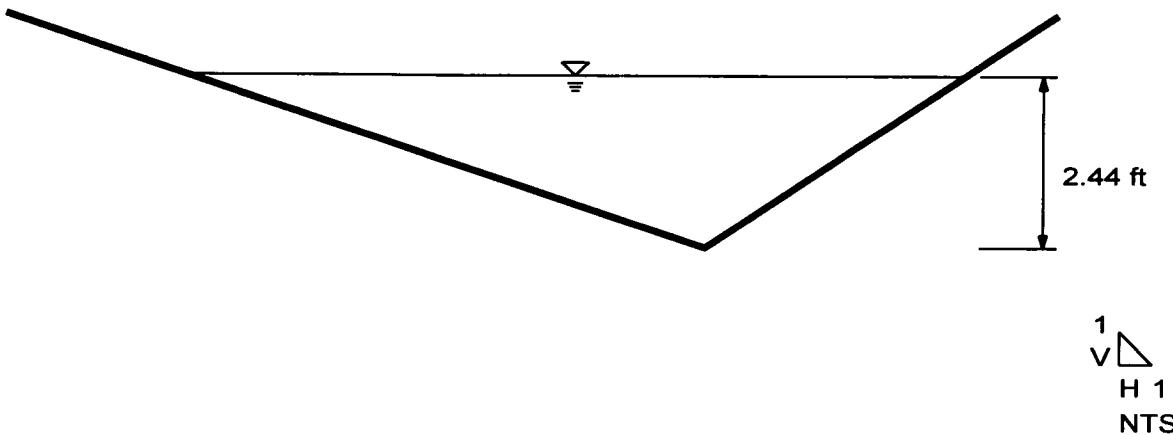
Cross Section for Triangular Channel

Project Description

Project File c:\haestad\fmw\reach h.fm2
Worksheet 100 year
Flow Element Triangular Channel
Method Manning's Formula
Solve For Channel Depth

Section Data

Mannings Coefficient 0.040
Channel Slope 0.050000 ft/ft
Depth 2.44 ft
Left Side Slope 3.000000 H : V
Right Side Slope 1.500000 H : V
Discharge 119.00 cfs



Worksheet

Worksheet for Trapezoidal Channel

Project Description

Project File	c:\haestad\fmw\reach i.fm2
Worksheet	10 year
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Mannings Coefficient	0.055
Channel Slope	0.240000 ft/ft
Left Side Slope	2.000000 H : V
Right Side Slope	2.000000 H : V
Bottom Width	6.00 ft
Discharge	25.00 cfs

Results

Depth	0.49	ft
Flow Area	3.39	ft ²
Wetted Perimeter	8.18	ft
Top Width	7.95	ft
Critical Depth	0.75	ft
Critical Slope	0.054353	ft/ft
Velocity	7.37	ft/s
Velocity Head	0.84	ft
Specific Energy	1.33	ft
Froude Number	1.99	

Flow is supercritical.

Cross Section

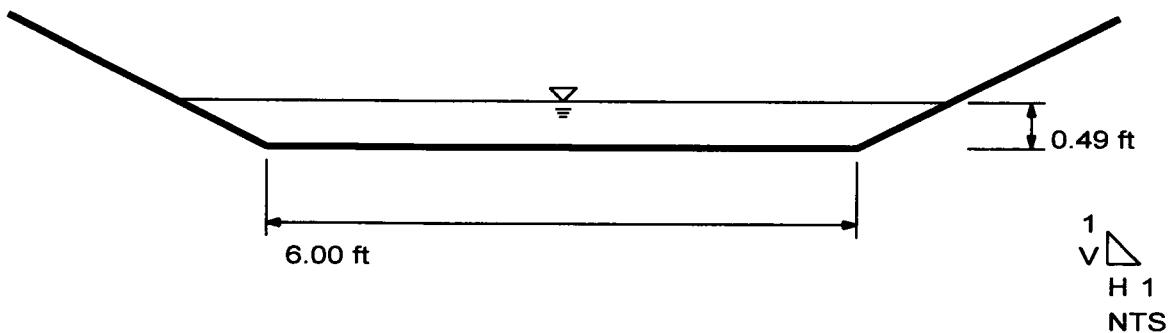
Cross Section for Trapezoidal Channel

Project Description

Project File c:\haestad\fmw\reach i.fm2
Worksheet 10 year
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Channel Depth

Section Data

Mannings Coefficient 0.055
Channel Slope 0.240000 ft/ft
Depth 0.49 ft
Left Side Slope 2.000000 H : V
Right Side Slope 2.000000 H : V
Bottom Width 6.00 ft
Discharge 25.00 cfs



Worksheet
Worksheet for Trapezoidal Channel

Project Description

Project File	c:\haestad\fmw\reach i.fm2
Worksheet	100 year
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Mannings Coefficient	0.055
Channel Slope	0.240000 ft/ft
Left Side Slope	2.000000 H : V
Right Side Slope	2.000000 H : V
Bottom Width	6.00 ft
Discharge	112.00 cfs

Results

Depth	1.14	ft
Flow Area	9.43	ft ²
Wetted Perimeter	11.09	ft
Top Width	10.56	ft
Critical Depth	1.80	ft
Critical Slope	0.043798	ft/ft
Velocity	11.88	ft/s
Velocity Head	2.19	ft
Specific Energy	3.33	ft
Froude Number	2.22	

Flow is supercritical.

Cross Section

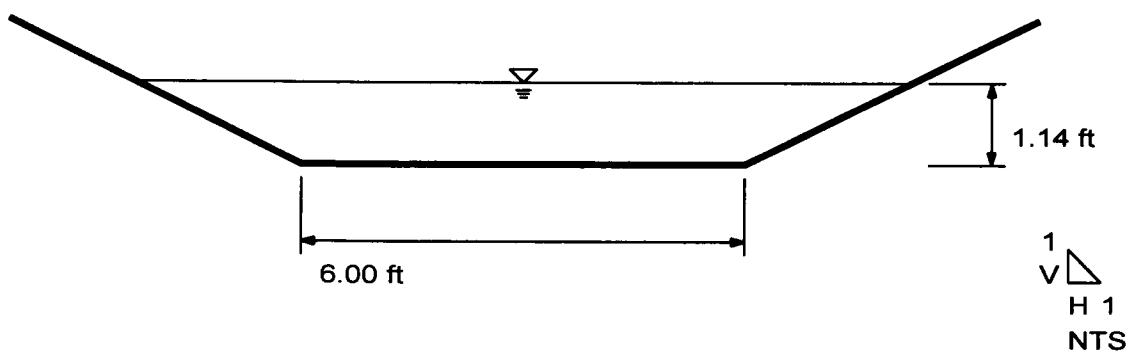
Cross Section for Trapezoidal Channel

Project Description

Project File	c:\haestad\fmw\reach i.fm2
Worksheet	100 year
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficient	0.055
Channel Slope	0.240000 ft/ft
Depth	1.14 ft
Left Side Slope	2.000000 H : V
Right Side Slope	2.000000 H : V
Bottom Width	6.00 ft
Discharge	112.00 cfs



Worksheet
Worksheet for Irregular Channel

Project Description

Project File	c:\haestad\fmw\reach j.fm2
Worksheet	100-year
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope 0.050000 ft/ft

Elevation range: 0.00 ft to 5.50 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	5.50	0.00	40.00	0.060
6.00	5.50			
16.00	0.50			
20.00	0.00			
24.00	0.50			
34.00	5.50			
40.00	5.50			

Discharge 112.00 cfs

Results

Wtd. Mannings Coefficient	0.060
Water Surface Elevation	1.94 ft
Flow Area	17.71 ft ²
Wetted Perimeter	14.52 ft
Top Width	13.77 ft
Height	1.94 ft
Critical Depth	1.93 ft
Critical Slope	0.051864 ft/ft
Velocity	6.32 ft/s
Velocity Head	0.62 ft
Specific Energy	2.56 ft
Froude Number	0.98

Flow is subcritical.

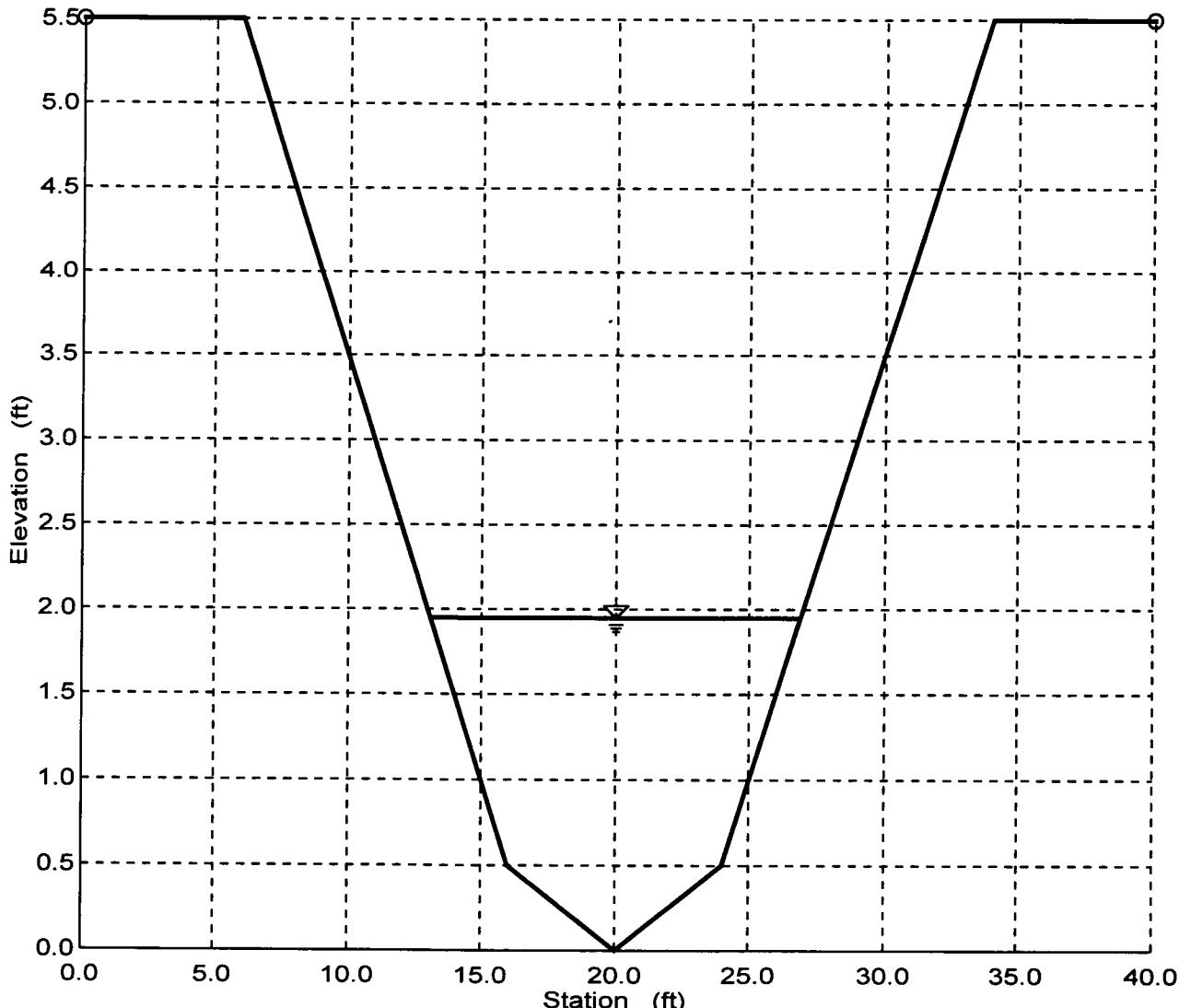
Cross Section Cross Section for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach.j.fm2
Worksheet 100-year
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Section Data

Wtd. Mannings Coefficient 0.060
Channel Slope 0.050000 ft/ft
Water Surface Elevation 1.94 ft
Discharge 112.00 cfs



DROP STRUCTURE DESIGN TEMPLATE
Barrick Resources (USA) Inc., Mercur Mine
Southern Diversion, Reach J

INPUT DATA:

TOTAL DISCHARGE - Q (CFS)	112 CFS	UNIT DISCHARG	5.60 CFS/FT
WIDTH OF WEIR - W (FT)	20 FT		
DROP HEIGHT - DELTA Z (FT)	3.5 FT	Plunge Pool Status:	
D90 PARTICLE SIZE (mm)	200 mm	Scour Controlled	

RESULTS:

CRITICAL DEPTH Yc (FT)	0.99 FT
JET THICKNESS Y1 (FT)	0.38 FT
POOL DEPTH UNDER NAPPE (FT)	1.52 FT
JUMP HT (FT)	2.09 FT
COUNTER WEIR HT (FT)	0.35 FT
DROP LENGTH (FT)	13.43 FT
JUMP LENGTH (FT)	11.82 FT
SCOUR DEPTH (FT)	0.93 FT
VELOCITY AT WEIR (FT/S)	5.65 FT/S
VELOCITY IN POOL (FT/S)	2.68 FT/S
TOTAL DIST BTWN DROPS (FT)	25.25 FT

Worksheet

Worksheet for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach.j.fm2
Worksheet 100-year
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Input Data

Channel Slope 0.050000 ft/ft

Elevation range: 0.00 ft to 5.50 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	5.50	0.00	40.00	0.060
6.00	5.50			
16.00	0.50			
20.00	0.00			
24.00	0.50			
34.00	5.50			
40.00	5.50			

Discharge 112.00 cfs

Results

Wtd. Mannings Coefficient	0.060
Water Surface Elevation	1.94 ft
Flow Area	17.71 ft ²
Wetted Perimeter	14.52 ft
Top Width	13.77 ft
Height	1.94 ft
Critical Depth	1.93 ft
Critical Slope	0.051864 ft/ft
Velocity	6.32 ft/s
Velocity Head	0.62 ft
Specific Energy	2.56 ft
Froude Number	0.98

Flow is subcritical.

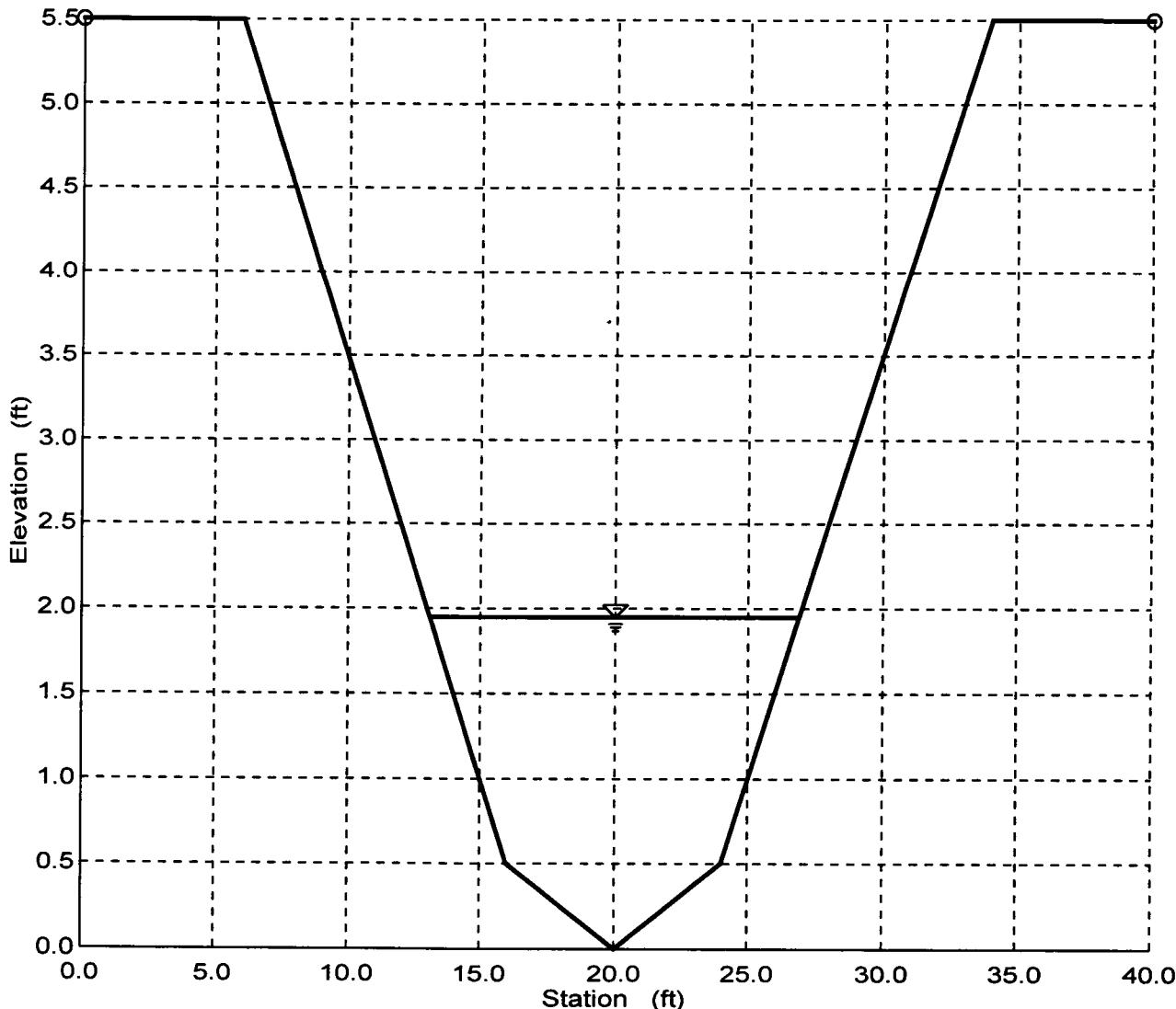
Cross Section Cross Section for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach j.fm2
Worksheet 100-year
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Section Data

Wtd. Mannings Coefficient 0.060
Channel Slope 0.050000 ft/ft
Water Surface Elevation 1.94 ft
Discharge 112.00 cfs



Worksheet
Worksheet for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach k.fm2
Worksheet 10-year
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Input Data

Channel Slope 0.002500 ft/ft

Elevation range: 0.00 ft to 3.00 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	3.00	0.00	23.00	0.033
3.00	3.00			
9.00	0.00			
19.00	0.00			
23.00	3.00			

Discharge 29.00 cfs

Results

Wtd. Mannings Coefficient	0.033
Water Surface Elevation	1.13 ft
Flow Area	13.48 ft ²
Wetted Perimeter	14.42 ft
Top Width	13.78 ft
Height	1.13 ft
Critical Depth	0.62 ft
Critical Slope	0.019951 ft/ft
Velocity	2.15 ft/s
Velocity Head	0.07 ft
Specific Energy	1.21 ft
Froude Number	0.38

Flow is subcritical.

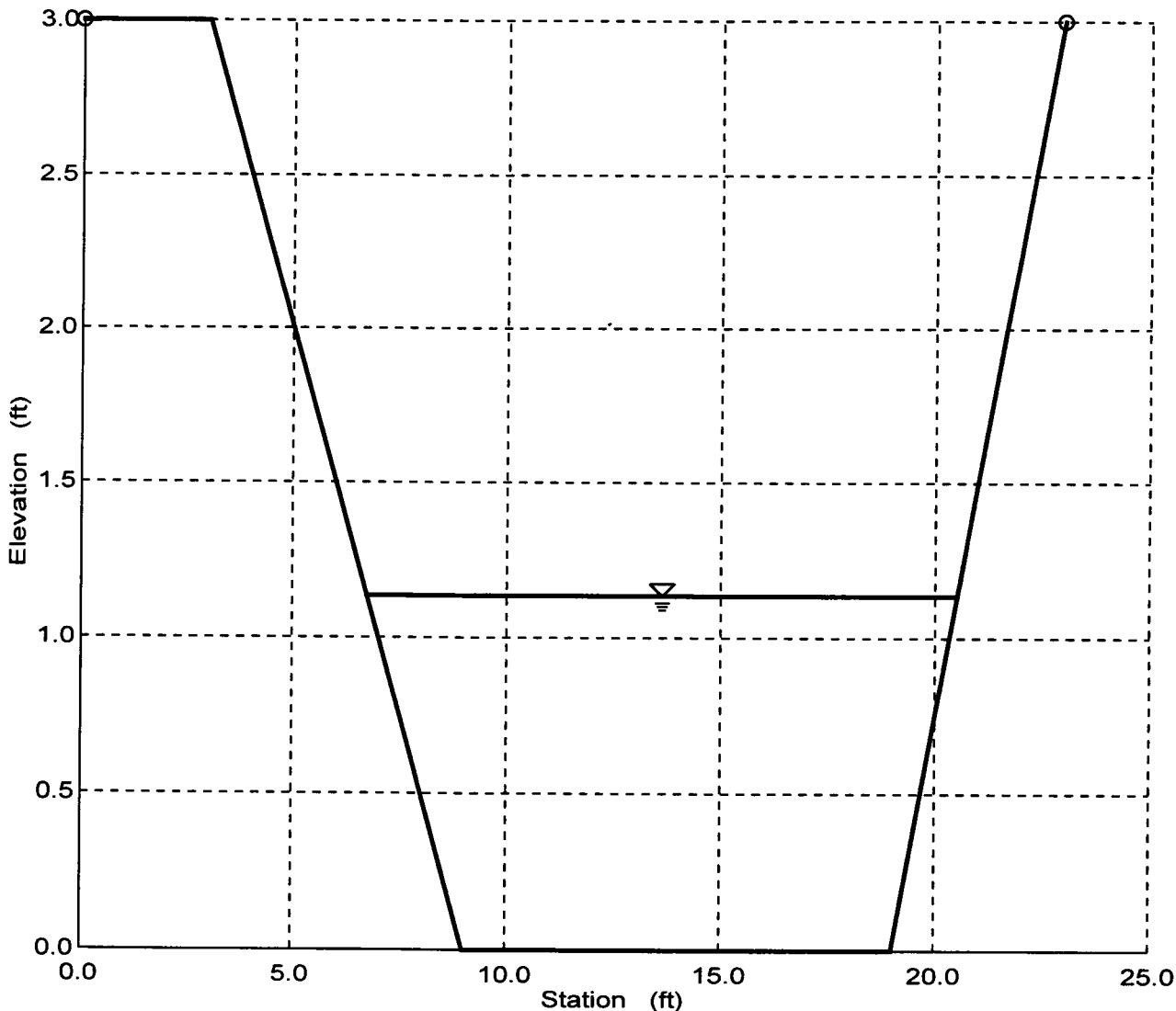
Cross Section Cross Section for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach k.fm2
Worksheet 10-year
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Section Data

Wtd. Mannings Coefficient 0.033
Channel Slope 0.002500 ft/ft
Water Surface Elevation 1.13 ft
Discharge 29.00 cfs



Worksheet

Worksheet for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach k.fm2
Worksheet 100-year
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Input Data

Channel Slope 0.050000 ft/ft

Elevation range: 0.00 ft to 3.00 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	3.00	0.00	23.00	0.033
3.00	3.00			
9.00	0.00			
19.00	0.00			
23.00	3.00			

Discharge 133.00 cfs

Results

Wtd. Mannings Coefficient	0.033
Water Surface Elevation	1.15 ft
Flow Area	13.71 ft ²
Wetted Perimeter	14.49 ft
Top Width	13.83 ft
Height	1.15 ft
Critical Depth	1.61 ft
Critical Slope	0.015602 ft/ft
Velocity	9.70 ft/s
Velocity Head	1.46 ft
Specific Energy	2.61 ft
Froude Number	1.72

Flow is supercritical.

Cross Section

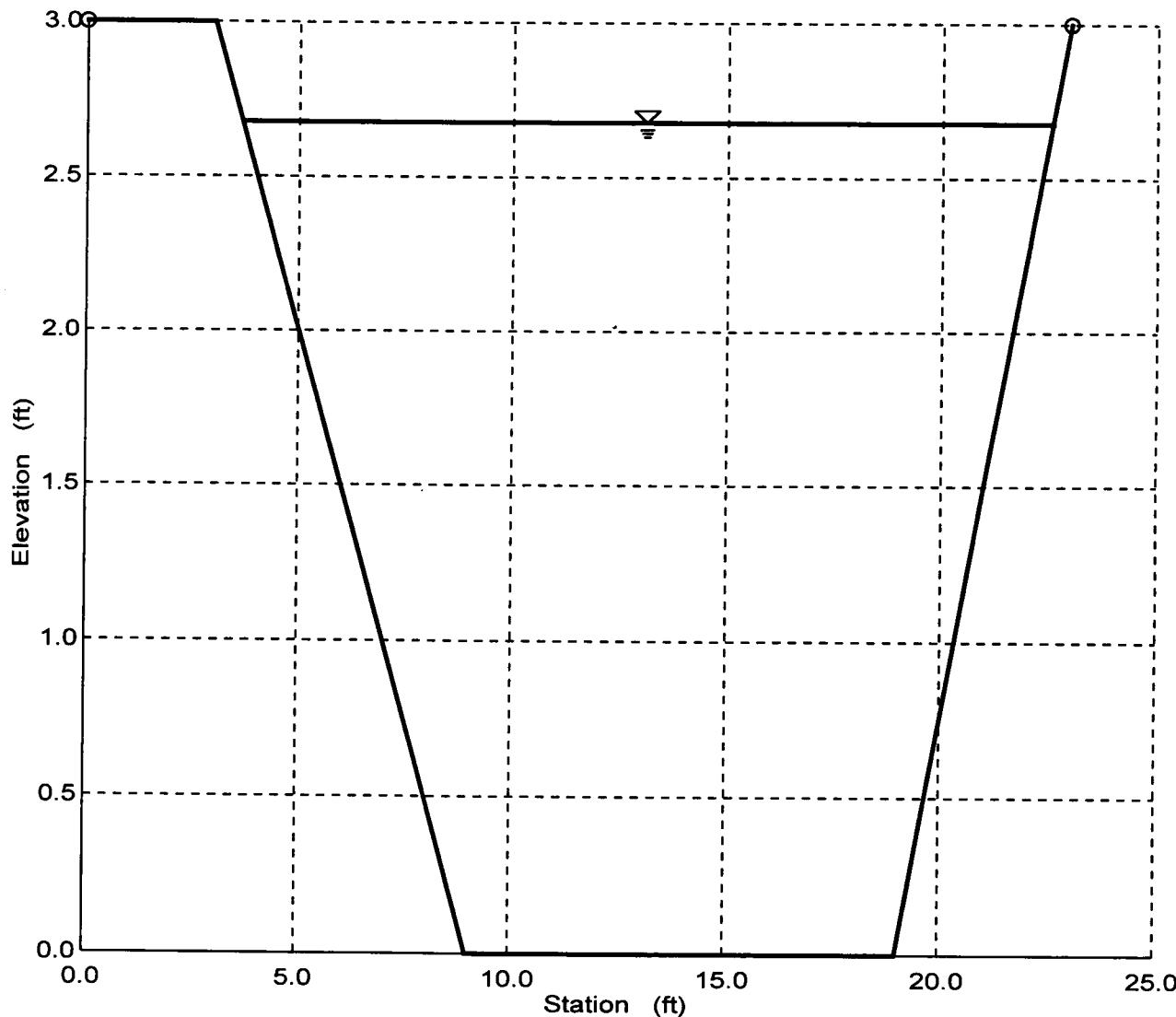
Cross Section for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach k.fm2
Worksheet 100-year
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Section Data

Wtd. Mannings Coefficient 0.033
Channel Slope 0.002500 ft/ft
Water Surface Elevation 2.67 ft
Discharge 133.00 cfs



Worksheet

Worksheet for Triangular Channel

Project Description

Project File c:\haestad\fmw\reach 1.fm2
Worksheet 10-year
Flow Element Triangular Channel
Method Manning's Formula
Solve For Channel Depth

Input Data

Mannings Coefficient 0.055
Channel Slope 0.300000 ft/ft
Left Side Slope 3.000000 H : V
Right Side Slope 3.000000 H : V
Discharge 33.00 cfs

Results

Depth 1.08 ft
Flow Area 3.49 ft²
Wetted Perimeter 6.82 ft
Top Width 6.47 ft
Critical Depth 1.50 ft
Critical Slope 0.052080 ft/ft
Velocity 9.46 ft/s
Velocity Head 1.39 ft
Specific Energy 2.47 ft
Froude Number 2.27
Flow is supercritical.

Cross Section

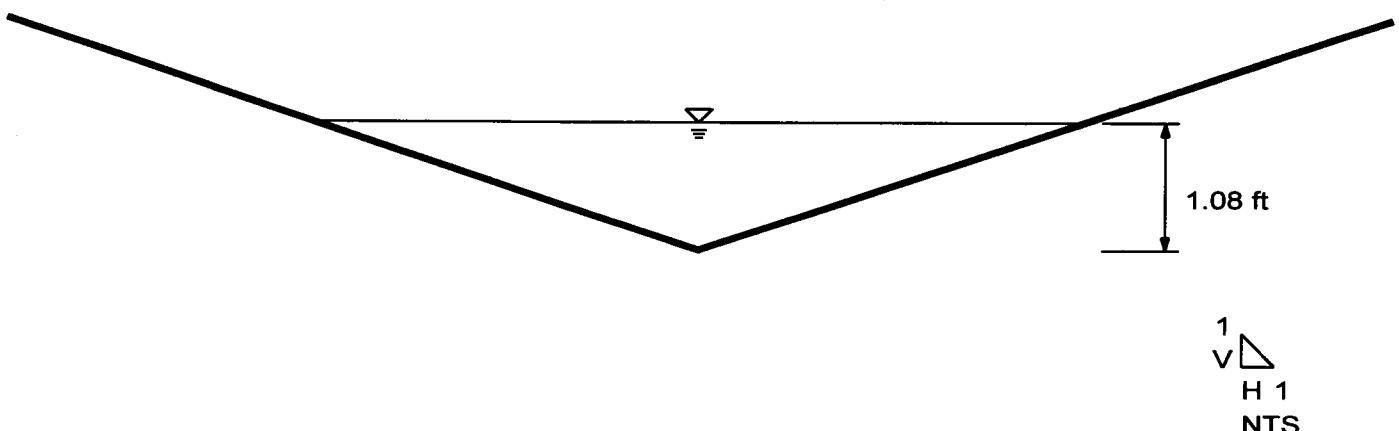
Cross Section for Triangular Channel

Project Description

Project File c:\haestad\fmw\reach 1.fm2
Worksheet 10-year
Flow Element Triangular Channel
Method Manning's Formula
Solve For Channel Depth

Section Data

Mannings Coefficient 0.055
Channel Slope 0.300000 ft/ft
Depth 1.08 ft
Left Side Slope 3.000000 H : V
Right Side Slope 3.000000 H : V
Discharge 33.00 cfs



Worksheet

Worksheet for Triangular Channel

Project Description

Project File c:\haestad\fmw\reach 1.fm2
Worksheet 100-year
Flow Element Triangular Channel
Method Manning's Formula
Solve For Channel Depth

Input Data

Mannings Coefficient 0.055
Channel Slope 0.300000 ft/ft
Left Side Slope 3.000000 H : V
Right Side Slope 3.000000 H : V
Discharge 139.00 cfs

Results

Depth 1.85 ft
Flow Area 10.25 ft²
Wetted Perimeter 11.69 ft
Top Width 11.09 ft
Critical Depth 2.66 ft
Critical Slope 0.042993 ft/ft
Velocity 13.56 ft/s
Velocity Head 2.86 ft
Specific Energy 4.70 ft
Froude Number 2.49

Flow is supercritical.

Cross Section

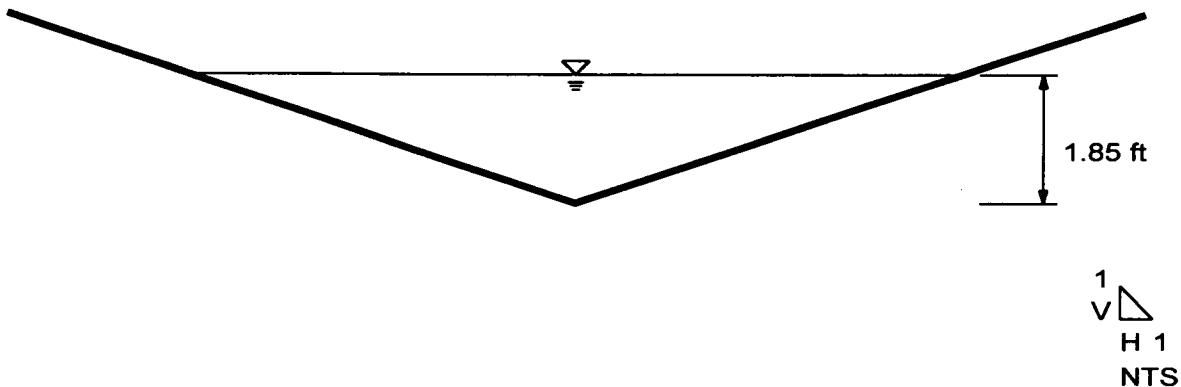
Cross Section for Triangular Channel

Project Description

Project File c:\haestad\fmw\reach 1.fm2
Worksheet 100-year
Flow Element Triangular Channel
Method Manning's Formula
Solve For Channel Depth

Section Data

Mannings Coefficient 0.055
Channel Slope 0.300000 ft/ft
Depth 1.85 ft
Left Side Slope 3.000000 H : V
Right Side Slope 3.000000 H : V
Discharge 139.00 cfs



Worksheet
Worksheet for Trapezoidal Channel

Project Description

Project File	c:\haestad\fmw\reach m.fm2
Worksheet	Reach M
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Mannings Coefficient	0.040
Channel Slope	0.050000 ft/ft
Left Side Slope	2.000000 H : V
Right Side Slope	1.500000 H : V
Bottom Width	0.00 ft
Discharge	33.00 cfs

Results

Depth	1.68	ft
Flow Area	4.92	ft ²
Wetted Perimeter	6.77	ft
Top Width	5.87	ft
Critical Depth	1.86	ft
Critical Slope	0.028925	ft/ft
Velocity	6.71	ft/s
Velocity Head	0.70	ft
Specific Energy	2.38	ft
Froude Number	1.29	

Flow is supercritical.

Cross Section

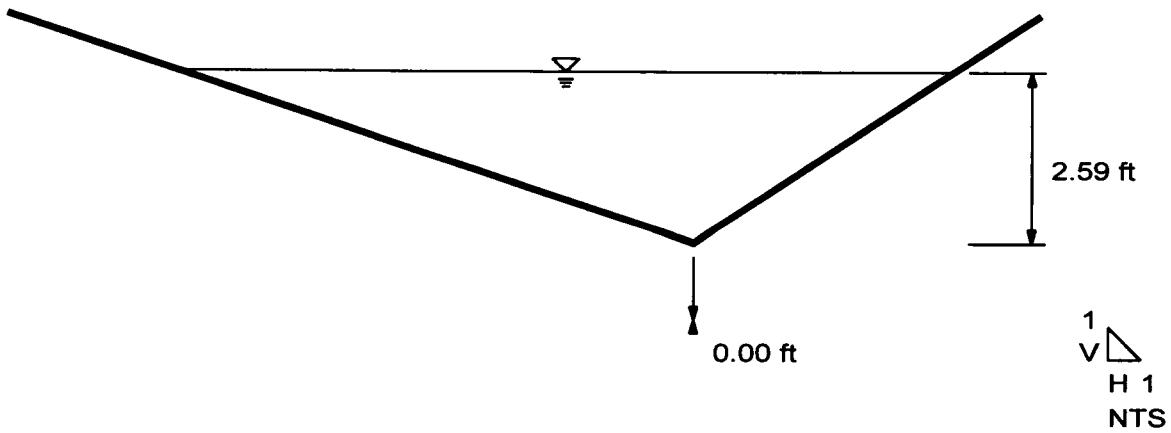
Cross Section for Trapezoidal Channel

Project Description

Project File c:\haestad\fmw\reach m.fm2
Worksheet 100-year
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Channel Depth

Section Data

Mannings Coefficient 0.040
Channel Slope 0.050000 ft/ft
Depth 2.59 ft
Left Side Slope 3.000000 H : V
Right Side Slope 1.500000 H : V
Bottom Width 0.00 ft
Discharge 139.00 cfs



Worksheet

Worksheet for Trapezoidal Channel

Project Description

Project File c:\haestad\fmw\reach m.fm2
Worksheet 100-year
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Channel Depth

Input Data

Mannings Coefficient 0.040
Channel Slope 0.050000 ft/ft
Left Side Slope 3.000000 H : V
Right Side Slope 1.500000 H : V
Bottom Width 0.00 ft
Discharge 139.00 cfs

Results

Depth 2.59 ft
Flow Area 15.05 ft²
Wetted Perimeter 12.84 ft
Top Width 11.64 ft
Critical Depth 2.99 ft
Critical Slope 0.023259 ft/ft
Velocity 9.23 ft/s
Velocity Head 1.33 ft
Specific Energy 3.91 ft
Froude Number 1.43

Flow is supercritical.

Cross Section

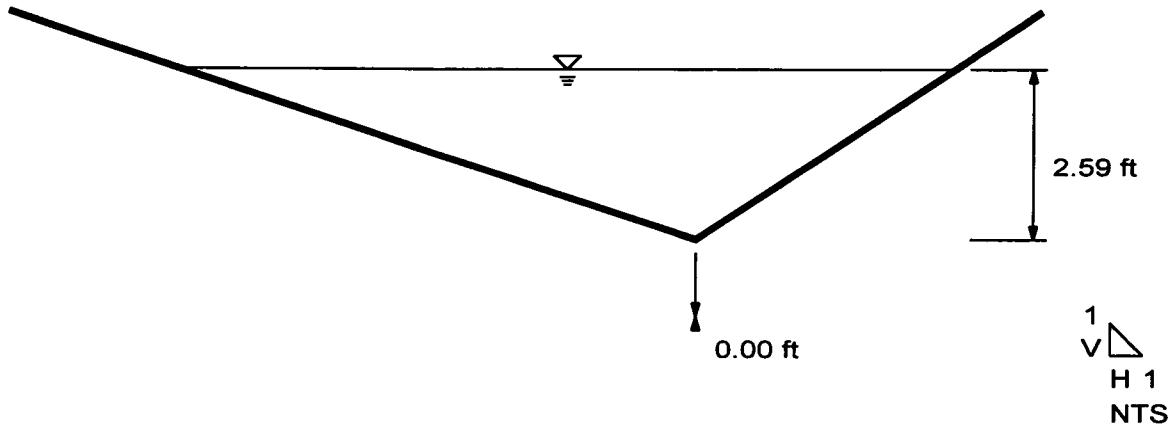
Cross Section for Trapezoidal Channel

Project Description

Project File c:\haestad\fmw\reach.m.fm2
Worksheet 100-year
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Channel Depth

Section Data

Mannings Coefficient 0.040
Channel Slope 0.050000 ft/ft
Depth 2.59 ft
Left Side Slope 3.000000 H : V
Right Side Slope 1.500000 H : V
Bottom Width 0.00 ft
Discharge 139.00 cfs



Worksheet

Worksheet for Irregular Channel

Project Description

Project File	c:\haestad\fmw\reach n.fm2
Worksheet	10-year
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope	0.100000 ft/ft
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Elevation range: 0.00 ft to 5.50 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	5.50	0.00	32.00	0.080
11.00	0.00			
21.00	0.00			
32.00	5.50			

Discharge	147.00	cfs
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Results

Wtd. Mannings Coefficient	0.080
Water Surface Elevation	1.63 ft
Flow Area	21.58 ft ²
Wetted Perimeter	17.28 ft
Top Width	16.51 ft
Height	1.63 ft
Critical Depth	1.68 ft
Critical Slope	0.089976 ft/ft
Velocity	6.81 ft/s
Velocity Head	0.72 ft
Specific Energy	2.35 ft
Froude Number	1.05

Flow is supercritical.

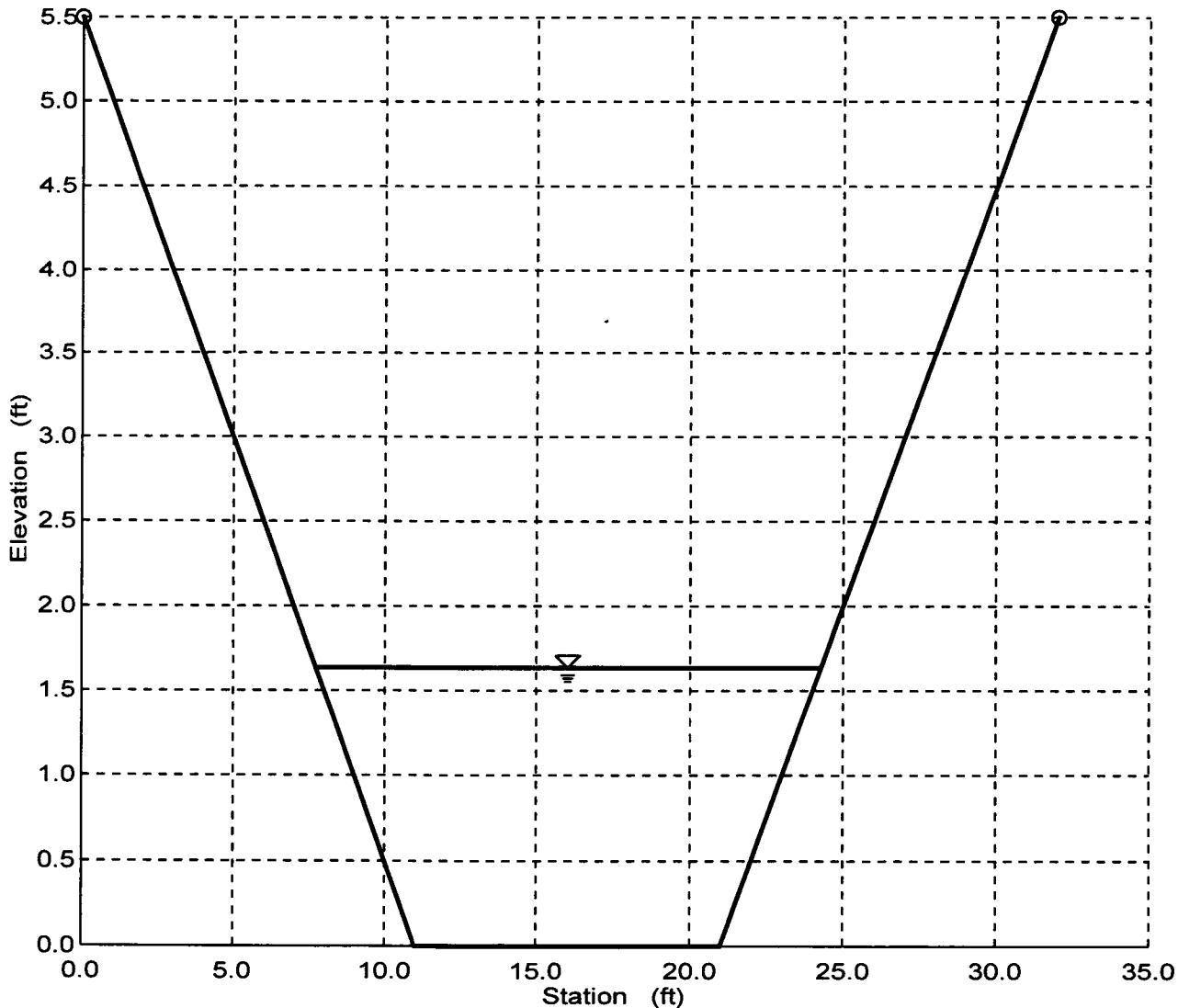
Cross Section Cross Section for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach n.fm2
Worksheet 10-year
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Section Data

Wtd. Mannings Coefficient 0.080
Channel Slope 0.100000 ft/ft
Water Surface Elevation 1.63 ft
Discharge 147.00 cfs



Worksheet

Worksheet for Irregular Channel

Project Description

Project File	c:\haestad\fmw\reach n.fm2
Worksheet	100-year
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope	0.100000 ft/ft
---------------	----------------

Elevation range: 0.00 ft to 5.50 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	5.50	0.00	32.00	0.080
11.00	0.00			
21.00	0.00			
32.00	5.50			

Discharge	492.00	cfs
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Results

Wtd. Mannings Coefficient	0.080
Water Surface Elevation	3.13 ft
Flow Area	50.79 ft ²
Wetted Perimeter	23.98 ft
Top Width	22.50 ft
Height	3.13 ft
Critical Depth	3.36 ft
Critical Slope	0.076073 ft/ft
Velocity	9.69 ft/s
Velocity Head	1.46 ft
Specific Energy	4.58 ft
Froude Number	1.14

Flow is supercritical.

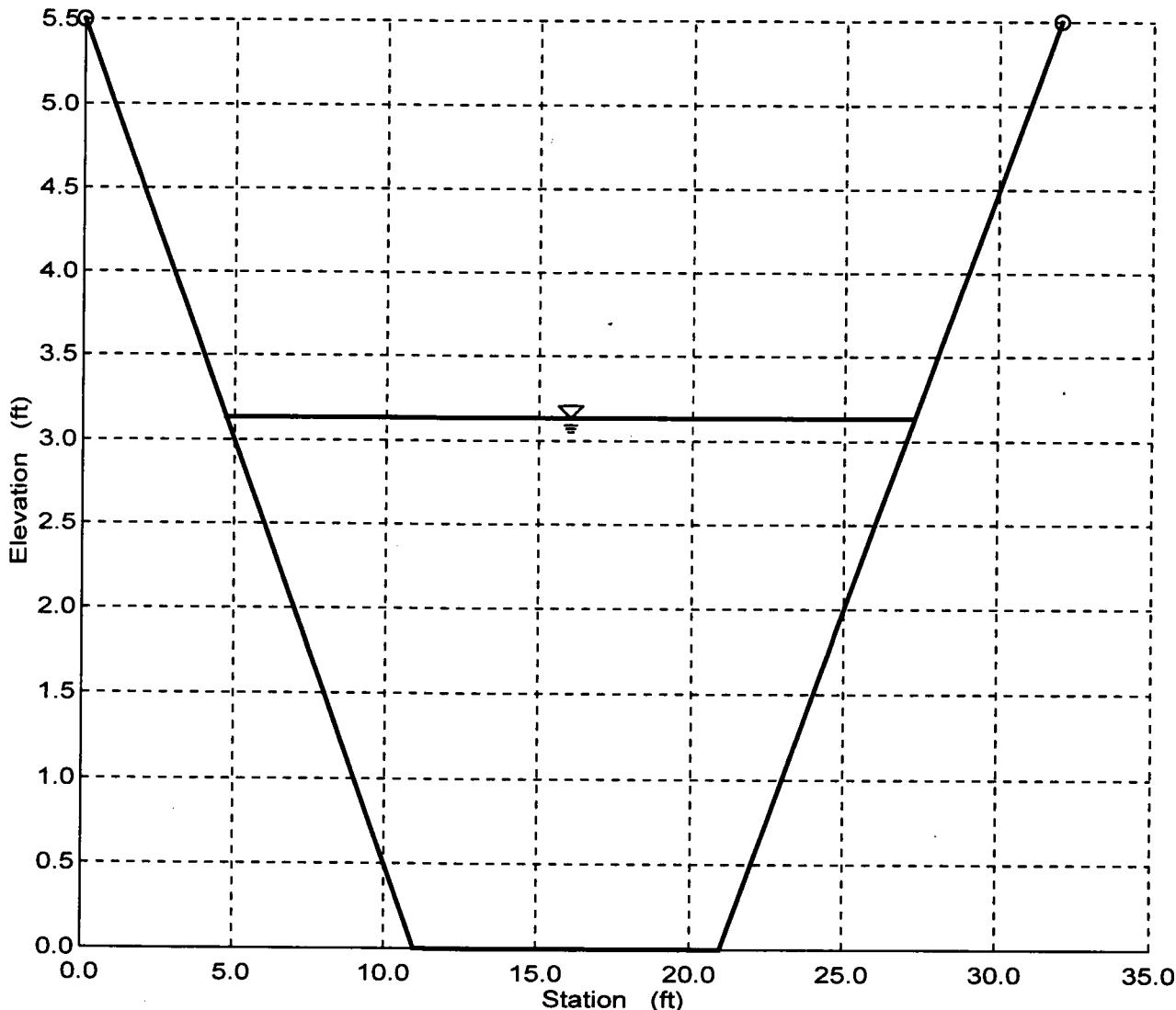
Cross Section Cross Section for Irregular Channel

Project Description

Project File c:\haestad\fmw\reach n.fm2
Worksheet 100-year
Flow Element Irregular Channel
Method Manning's Formula
Solve For Water Elevation

Section Data

Wtd. Mannings Coefficient 0.080
Channel Slope 0.100000 ft/ft
Water Surface Elevation 3.13 ft
Discharge 492.00 cfs



DROP STRUCTURE DESIGN TEMPLATE
Barrick Resources (USA) Inc., Mercur Mine
Southern Diversion, Reach N

INPUT DATA:

TOTAL DISCHARGE - Q (CFS)	147 CFS	UNIT DISCHARGE (CFS/FT)	6.125
WIDTH OF WEIR - W (FT)	24 FT		
DROP HEIGHT - DELTA Z (FT)	2.5 FT	Plunge Pool Status:	
D90 PARTICLE SIZE (mm)	150 mm	Scour Controlled	

RESULTS:

CRITICAL DEPTH Yc (FT)	1.05 FT
JET THICKNESS Y1 (FT)	0.45 FT
POOL DEPTH UNDER NAPPE (FT)	1.41 FT
JUMP HT (FT)	2.06 FT
COUNTER WEIR HT (FT)	0.34 FT
DROP LENGTH (FT)	9.94 FT
JUMP LENGTH (FT)	11.12 FT
SCOUR DEPTH (FT)	0.98 FT
VELOCITY AT WEIR (FT/S)	5.82 FT/S
VELOCITY IN POOL (FT/S)	2.97 FT/S
TOTAL DIST BTWN DROPS (FT)	21.06 FT

Worksheet

Worksheet for Triangular Channel

Project Description

Project File c:\haestad\fmw\temporar.fm2
Worksheet Reach O, 10-year
Flow Element Triangular Channel
Method Manning's Formula
Solve For Channel Depth

Input Data

Mannings Coefficient 0.035
Channel Slope 0.050000 ft/ft
Left Side Slope 10.000000 H : V
Right Side Slope 1.500000 H : V
Discharge 50.00 cfs

Results

Depth 1.16 ft
Flow Area 7.73 ft²
Wetted Perimeter 13.74 ft
Top Width 13.33 ft
Critical Depth 1.36 ft
Critical Slope 0.021119 ft/ft
Velocity 6.47 ft/s
Velocity Head 0.65 ft
Specific Energy 1.81 ft
Froude Number 1.50
Flow is supercritical.

Cross Section

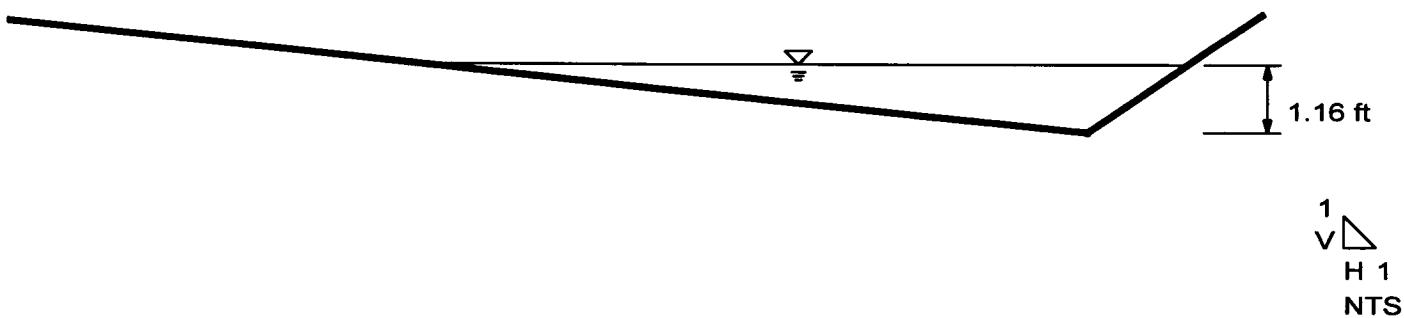
Cross Section for Triangular Channel

Project Description

Project File c:\haestad\fmw\temporar.fm2
Worksheet Reach O, 10-year
Flow Element Triangular Channel
Method Manning's Formula
Solve For Channel Depth

Section Data

Mannings Coefficient 0.035
Channel Slope 0.050000 ft/ft
Depth 1.16 ft
Left Side Slope 10.000000 H : V
Right Side Slope 1.500000 H : V
Discharge 50.00 cfs



riprap

Barrick Resources (USA) Inc.
Mercur Mine Closure
RIPRAP SIZING

Channel	Event	Discharge (cfs)	Average Flow Velocity (fps)	Maximum Depth in Channel (ft)	Froude #	D50 (in)	D90 (in)	D100 (in)	Blanket Thickness (in)	Notes
NORTHERN										
A	100-yr	173	4.33	2.97	0.44	1	1	2	2	
B	100-yr	221	6.31	1.96	0.79	4	5	7	7	bedrock
C	10-yr	109	3.37	4.12	0.29	0	1	1	1	
D	100-yr	623	5.1	6.31	0.36	1	2	2	2	
E	100-yr	623	12.13	4.53	1.00	19	24	31	31	generally bedrock
F	10-yr	135	8.46	1.08	1.43	14	17	22	22	Rock Vortex Weirs
G	10-yr	139	10	1.14	1.65	22	27	35	35	Rock Vortex Weirs
SOUTHERN										
H	100-yr	119	8.88	2.44	1.00	10	13	17	17	bedrock
I	10-yr	29	7.74	0.53	1.87	15	19	24	24	Drop
J	100-yr	112	10.22	1.94	1.29	18	22	29	29	Rock Vortex Weirs
K	10-yr	29	2.15	1.13	0.36	0	0	0	0	bedrock
L	10-yr	33	9.46	1.08	1.60	19	24	31	31	Drop
M	10-yr	33	6.71	1.68	0.91	5	7	9	9	V ditch
N	10-yr	181	9.6	1.46	1.40	17	21	27	27	Rock Vortex Weirs

StormSHED	FLOWMASTER						Manning Equation	Yang (1987) 3	Use Yang ¹	Gradations from Test Pit Program			Notes			
	Flow Rate (cfs)	Area x Velocity	Hydraulic Radius, R (ft)	Wetted Perimeter, P (ft)	Flow Area, A (sq ft)	Depth (ft)	Manning Number (n)	Hydraulic Slope (ft/ft)	Velocity (fps)	Sediment Size at Incipient Motion (in)	% Greater than Sediment in Motion	Armor Layer Thickness (in)	Depth of Degradation to Achieve Armor Layer (in)			
NORTHERN DIVERSION																
A (100 year flow)	173	1.38	28.99	39.91	2.97	27.77	0.03	0.005	4.35	1.49	0.04	1.18	25%	2.99	8.96	
C	493	1.29	107.24	138.32	3.55	101.53	0.035	0.005	3.57	1.01	0.51	3.07	50%	2.01	2.01	
C1	256	1.28	28.36	36.22	1.8	22.77	0.035	0.02	7.09	3.97	0.51	3.07	13%	6.00	40.15	
D	629	2.21	55.79	123.41	6.31	53.29	0.035	0.005	5.11	2.06	0.51	3.07	20%	4.13	16.52	
E	623	2.10	24.47	51.36	4.53	22.66	0.055	0.075	12.16	11.69	0.47	5.90	50%	6.00	D50 riprap=12"	
F	623	2.10	31.68	66.4	3.11	30.67	0.058	0.05	9.41	7.00	0.51	2.56	10%	6.00	54.00	
G	623	2.45	26.72	65.34	3.74	24.95	0.1	0.125	9.56	7.23	0.47	2.95	10%	6.00	54.00	
SOUTHERN DIVERSION																
H	119	1.11	12.12	13.4	2.44	10.98	0.04	0.05	8.91	6.27	NA	NA	50%	6.00	6.00	
I	112	0.85	11.09	9.43	1.14	10.56	0.055	0.24	11.91	11.22	bedrock	50%	6.00	6.00	D50 riprap=6"	
J	112	1.22	14.52	17.71	1.94	13.77	0.06	0.05	6.34	3.18	0.43	11.80	45%	6.00	7.33	
K	133	0.95	14.49	13.71	1.15	13.83	0.033	0.05	9.73	7.49	bedrock	NA	NA	6.00	D50 riprap=6"	
L	139	0.88	11.69	10.25	1.85	11.09	0.055	0.3	13.59	14.61	14.61	1.57	11.80	45%	6.00	D50 riprap=12"
M	139	1.17	12.84	15.05	2.59	11.64	0.04	0.05	9.26	6.78	6.78	1.50	11.81	50%	6.00	D50 riprap=6"
N	492	2.12	23.98	50.79	3.13	22.5	0.08	0.1	9.71	7.46	1.14	5.90	10%	6.00	54.00	

1 Other common methods do not use velocity directly but depth and slope, therefore Manning's n is not included in those analysis
NA Not Available